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HOW DO YOU THINK?

There are four groups of people in our society who are basically interested in how human beings think: the psychologist, the politician, the computerman, and the neurosurgeon.

The interest of the psychologist is obvious, and long recognized. The interest of the politician is even older, and more firmly entrenched. Both of these groups—particularly the clinical psychologist, personnel psychologist and psychotherapist—are interested in practical results, which boils down to *what* rather than *how*. The advertising man and the politician, like the psychotherapist, are seeking to induce human beings to accept the line of thinking they choose to arouse, or to divert the individual from an undesired line of thought. To them *how thinking is done* is of less importance basically than *how to change thinking*.

The interest of the computermen is obvious; to date, the human mind is the only mechanism known that is capable of creative thought. Creative thinking might be defined, for the purpose of discussion, as the ability to get correct answers from inadequate data; a computer can give the right answer if it is supplied with all the necessary factors. The unique quality of a human being is that he can get right answers when the data is inadequate, inaccurate, irrelevant, and/or mistaken. When the computerman can make a machine that, given only seventy per cent of the necessary correct data, an equal amount of totally irrelevant data, an additional twenty per cent of the needed data in a wrong, misevaluated, or inaccurate manner, and still come up with an exact and correct answer—he'll have a machine that can think. Human beings can; it's called "creative thinking." The computermen would most ardently like to know how in blazes a couple of pounds of grayish protoplasm turns the neat little trick. There has been discussion in the Brass Tacks section of the nature of "Phinnaegel's Constant" under various names; essentially it's the Quantity which, when multiplied by, divided into, subtracted from or added to the wrong answer yields the right answer. To date, the only known example of Phinnaegel's Constant is an active human mind; computermen would love to have the technique of deriving that Quantity, and build it into their machines. In

essence, they need the gimmick that will take in data with an average accuracy of plus or minus twenty per cent and using equipment that is accurate to plus or minus ten per cent, turn out answers accurate to 0.2%. Human beings do it every day, and do it just fine!

The interest of the neurosurgeon, however, was not clear to me until I had lunch with a neurosurgical researcher the other day. Basically, the neurosurgeon's problem is that of repairing a damaged piece of high-precision equipment the operating principles of which he does not know. The regular radio repairman, working with circuit diagram and test meters, has troubles enough with a ten-tube radio. With the modern thirty-plus-tube television set, a higher level of technician is required. Now let's hand the repair technician a piece of equipment with the comment, "My matter transmitter isn't working well; will you fix it please?"

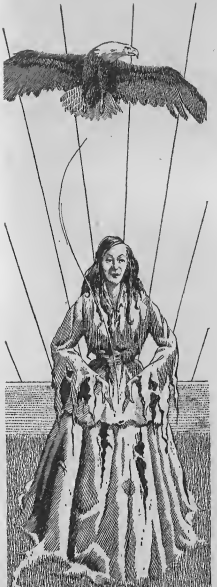
The neurosurgeon is seeking to repair a human brain, damaged in an accident, by a tumor, disease, or by some undetermined cause. What does a brain do? It thinks. Fine—and a matter transmitter transmits matter. It would help enormously if the neurosurgeon had some idea of *how* thinking is done. The more closely he can correlate malfunction as observed by the individual's actions and reactions with structural mechanism, the better he can do his job.

The first step in doing this is, necessarily, finding out what the actual function of the mind is. True, the brain controls body motions; the areas relating to mechanical function of the body, and to sensory perception areas, have been fairly well plotted out. But a St. Bernard dog weighs about as much as a man, has a body of about equal size and complexity, and gets along nicely on a great deal less brain—and even it is a highly intelligent animal, immeasurably exceeding in intelligence the biggest computing machine yet built. So what's the major portion of the human brain there for? What's its function?

Particularly confusing is the fact that major portions of the brain can be destroyed, with no apparent decrease in the operating efficiency of the human being. Pasteur, for example, lost nearly half his brain by disease in his youth; all of his great work was done, quite literally, with a lame brain.

Until the neurosurgeons know how men think, it is almost impossible to develop the knowledge necessary to carry on their immensely important work. And it is immeasurably important to those human beings who need their help; most of us would gladly sacrifice two legs and an arm rather than a small part of our ability to think, and have being as "I". Descartes "*Cogito; ergo sum* has as its corollary, "If I do not think, I am

(*Continued on page 160*)



FIREWATER

BY WILLIAM TENN

***The Aliens** were destroying humanity's self-respect; the Primeys were giving men wonderful devices, and acute headaches, and—nobody had an answer. But sometimes "Business As Usual" pays off!*

Illustrated by van Dongen

The hairiest, dirtiest and oldest of the three visitors from Arizona scratched his back against the plastic of the webfoam chair. "Insinuations are lavender nearly," he remarked by way of opening the conversation.

His two companions — the thin young man with dripping eyes, and the woman whose good looks were marred chiefly by incredibly decayed teeth—giggled and relaxed. The thin young man said "Gabble, gabble, honk!" under his breath, and the other two nodded emphatically.

Greta Seidenheim looked up from the tiny stenographic machine resting on a pair of the most exciting knees her employer had been able to find in Greater New York. She swiveled her blond beauty at him. "That too, Mr. Hebster?"

The president of Hebster Securities, Inc., waited until the memory of her voice ceased to tickle his ears; he had much clear thinking to do. Then he nodded and said resonantly, "That too, Miss Seidenheim. Close phonetic approximations of the gabble-honk and remember to indicate when it sounds like a question and when like an exclamation."

He rubbed his recently manicured fingernails across the desk drawer containing his fully loaded Parabellum. Check. The communication buttons with which he could summon any quantity of Hebster Securities personnel up to the nine hundred working at present in the Hebster Building lay some eight inches from the other hand. Check. And there were the doors here, the doors there, behind which his uniformed bodyguard stood poised to burst in at a signal which would blaze before them the moment his right foot came off the tiny spring set in the floor. *And* check.

Algernon Hebster could talk business—even with Primeys.

Courteously, he nodded at each one of his visitors from Arizona; he smiled ruefully at what the dirty shapeless masses they wore on their feet were doing to the calf-deep rug that had been woven specially for his private office. He had greeted them when Miss Seidenheim had escorted them in. They had laughed in his face.

"Suppose we rattle off some introductions. You know me. I'm Hebster, Algernon Hebster—you asked for me specifically at the desk in the lobby. If it's important to the conversation, my secretary's name is Greta Seidenheim. And you, sir?"

He had addressed the old fellow, but the thin young man leaned forward in his seat and held out a taut, almost transparent hand. "Names?" he inquired. "Names are round if not revealed. Consider names. How many names? Consider names, *reconsider* names!"

The woman leaned forward too, and the smell from her diseased mouth reached Hebster even across the enormous space of his office. "Rabble and reaching and all the upward clash," she intoned, spreading her hands as if in agreement with an obvious point. "Emptiness derogating itself into infinity—"

"Into duration," the older man corrected.

"Into infinity," the woman insisted.

"Gabble, gabble, honk?" the young man queried bitterly.

"Listen!" Hebster roared. "When I asked for—"

The communicator buzzed and he drew a deep breath and pressed a button. His receptionist's voice boiled out rapidly, fearfully:

"I remember your orders, Mr. Hebster, but those two men from the UM Special Investigating Commission are here again and they look as if they mean business. I mean they look as if they'll make trouble."

"Yost and Funatti?"

"Yes, sir. From what they said to each other, I think they know you have three Primeys in there. They asked me what are you trying to do—deliberately inflame the Firsters? They said they're going to invoke full supranational powers and force an entry if you don't—"

"Stall them."

"But, Mr. Hebster, the *UM Special Investigating*—"

"Stall them, I said. Are you a receptionist or a swinging door? Use your imagination, Ruth. You have a nine-hundred-man organization and a ten-million-dollar corporation at your disposal. You can stage any kind of farce in that outer office you want—up to and including the deal where some actor made up to look like me walks in and drops dead at their feet. Stall them and I'll nod a bonus at you. *Stall them.*" He clicked off, looked up.

His visitors, at least, were having a fine time. They had turned to face each other in a reeking triangle of gibberish. Their voices rose and fell argumentatively, pleadingly, decisively; but all Algernon Hebster's ears could register of what they said were very many sounds similar to *gabble* and an occasional, indisputable *honk!*

His lips curled contempt inward. Humanity prime! *These* messes? Then he lit a cigarette and shrugged. Oh, well. Humanity prime. And business is business.

Just remember they're not supermen, he told himself. *They may be dangerous, but they're not supermen. Not by a long shot. Remember that epidemic of influenza that almost wiped them out, and how you diddled those two other Primeys last month. They're not supermen, but they're not humanity either. They're just different.*

He glanced at his secretary and approved. Greta Seidenheim clacked away on her machine as if she were recording the curtest, the tritest of business letters. He wondered what system she was using to catch the intonations. Trust Greta, though, she'd do it.

"Gabble, honk! Gabble, gabble, gabble, honk, honk. Gabble, honk, gabble, gabble, honk? Honk."

What had precipitated all this conversation? He'd only asked for their names. Didn't they use names in Arizona? Surely, they knew that it was customary here. They claimed to know at least as much as he about such matters.

Maybe it was something else that had brought them to New York this time—maybe something about the Aliens? He felt the short hairs rise on the back of his neck and he smoothed

them down self-consciously.

Trouble was it was so *easy* to learn their language. It was such a very simple matter to be able to understand them in these talkative moments. Almost as easy as falling off a log—or jumping off a cliff.

Well, his time was limited. He didn't know how long Ruth could hold the UM investigators in his outer office. Somehow he had to get a grip on the meeting again without offending them in any of the innumerable, highly dangerous ways in which Primeys could be offended.

He rapped the desk top—gently. The gabble-honk stopped short at the hyphen. The woman rose slowly.

"On this question of names," Hebster began doggedly, keeping his eyes on the woman, "since you people claim—"

The woman writhed agonizingly for a moment and sat down on the floor. She smiled at Hebster. With her rotted teeth, the smile had all the brilliance of a dead star.

Hebster cleared his throat and prepared to try again.

"If you want names," the older man said suddenly, "you can call me Larry."

The president of Hebster Securities shook himself and managed to say "Thanks" in a somewhat weak but not too surprised voice. He looked at the thin young man.

"You can call me Theseus." The young man looked sad as he said it.

"Theseus? Fine!" One thing about Primeys when you started clicking with them, you really moved along. But *Theseus!* Wasn't that just like a Primey? Now the woman, and they could begin.

They were all looking at the woman, even Greta with a curiosity which had sneaked up past her beauty-parlor glaze.

"Name," the woman whispered to herself. "Name a name."

Oh, no, Hebster groaned. *Let's not stall here.*

Larry evidently had decided that enough time had been wasted. He made a suggestion to the woman. "Why not call yourself Moe?"

The young man—Theseus, it was now—also seemed to get interested in the problem. "Rover's a good name," he announced helpfully.

"How about Gloria?" Hebster asked desperately.

The woman considered. "Moe, Rover, Gloria," she mused. "Larry, Theseus, Seidenheim, Hebster, me." She seemed to be running a total.

Anything might come out, Hebster knew. But at least they were not acting snobbish any more: they were talking down on his level now. Not only no gabble-honk, but none of this sneering double-talk which was almost worse. At least they were making sense—of a sort.

"For the purposes of this discussion," the woman said at last, "my name will be . . . will be—My name *is* S.S. Lusitania."

"Fine!" Hebster roared, letting the word he'd kept bubbling on his lips burst out. "That's a *fine* name. Larry, Theseus and . . . er, S.S. Lusitania. Fine bunch of people. Sound. Let's get down to business. You came here on business, I take it?"

"Right," Larry said. "We heard about you from two others who left home a month ago to come to New York. They talked about you when they got back to Arizona."

"They did, eh? I hoped they would."

Theseus slid off his chair and squatted next to the woman who was making plucking motions at the air. "They talked about you," he repeated. "They said you treated them very well, that you showed them as much respect as a thing like you could generate. They also said you cheated them."

"Oh, well, Theseus," Hebster spread his manicured hands. "I'm a businessman."

"You're a businessman," S.S. Lusitania agreed, getting to her feet stealthily and taking a great swipe with both hands at something invisible in front of her face. "And here, in this spot, at this moment, so are we. You can have what we've brought, but you'll pay for it. And don't think you can cheat *us*."

Her hands, cupped over each other, came down to her waist. She pulled them apart suddenly and a tiny eagle fluttered out. It flapped toward the fluorescent panels glowing in the ceiling. Its flight was hampered by the heavy, striped shield upon its breast, by the bunch of arrows it held in one claw, by the olive branch it grasped with the other. It turned its miniature bald head and gasped at Algernon Hebster, then began to drift rapidly down to the rug. Just before it hit the floor, it disappeared.

Hebster shut his eyes, remembering the strip of bunting that had fallen from the eagle's beak when it had turned to gasp. There had been words printed on the bunting, words too small to see at the distance, but he was sure the words would have read "*E Pluribus Unum.*" He was as certain of that as he was of the necessity of acting unconcerned over the whole incident, as unconcerned as the Primeys. Professor Kleimbocher said Primeys were mental drunkards. But why did they give everyone else the D.T.'s?

He opened his eyes. "Well," he said, "what have you to sell?"

Silence for a moment. Theseus seemed to forget the point he was trying to make; S.S. Lusitania stared at Larry.

Larry scratched his right side through heavy, stinking cloth.

"Oh, an infallible method for defeating anyone who attempts to apply the *reductio ad absurdum* to a reasonable proposition you advance." He yawned smugly and began scratching

his left side.

Hebster grinned because he was feeling so good. "No. Can't use it."

"Can't use it?" The old man was trying hard to look amazed. He shook his head. He stole a sideways glance at S.S. Lusitania.

She smiled again and wriggled to the floor. "Larry still isn't talking a language you can understand, Mr. Hebster," she cooed, very much like a fertilizer factory being friendly. "We came here with something we know you need badly. Very badly."

"Yes?" *They're like those two Primeys last month,* Hebster exulted: *they don't know what's good and what isn't. Wonder if their masters would know. Well, and if they did—who does business with Aliens?*

"We . . . have," she spaced the words carefully, trying pathetically for a dramatic effect, "a new shade of red, but not merely that. Oh, *no!* A new shade of red, and a full set of color values derived from it! A complete set of color values derived from this one shade of red, Mr. Hebster! Think what a non-objectivist painter can do with such a—"

"Don't sell me, lady. Theseus, do you want to have a go now?"

Theseus had been frowning at the green foundation of the desk. He leaned back, looking satisfied. Hebster realized abruptly that the tension under his right foot had disappeared. Somehow, Theseus had become cognizant of the signal-spring set in the floor; and, somehow, he had removed it.

He had disintegrated it without setting off the alarm to which it was wired.

Giggles from three Primey throats and a rapid exchange of "gabble-honk." Then they all knew what Theseus had done and how Hebster had tried to protect himself. They weren't angry, though—and they didn't sound triumphant. Try to understand Primey behavior!

No need to get unduly alarmed—the price of dealing with these characters was a nervous stomach. The rewards, on the other hand—

Abruptly, they were businesslike again.

Theseus snapped out his suggestion with all the finality of a bazaar merchant making his last, absolutely the last offer. "A set of population indices which can be correlated with—"

"No, Theseus," Hebster told him gently.

Then, while Hebster sat back and enjoyed, temporarily forgetting the missing coil under his foot, they poured out more, desperately, feverishly, weaving in and out of each other's sentences.

"A portable neutron stabilizer for high altit—"

"More than fifty ways of saying 'however' without—"

". . . So that every housewife can do an *entrechat* while cook—"

". . . Synthetic fabric with the drape of silk and manufactura—"

". . . Decorative pattern for bald heads using the follicles as—"

". . . Complete and utter refutation of all pyramidologists from—"

"All right!" Hebster roared, "*All right!* That's enough!"

Greta Seidenheim almost forgot herself and sighed with relief. Her stenographic machine had been sounding like a centrifuge.

"Now," said the executive. "What do you want in exchange?"

"One of those we said is the one you want, eh?" Larry muttered. "Which one—the pyramidology refutation? That's it, I betcha."

S.S. Lusitania waved her hands contemptuously. "Bishop's miters, you fool! The new red color values excited him. The new—"

Ruth's voice came over the communicator. "Mr. Hebster, Yost and Funatti are back. I stalled them, but I just received word from the lobby receptionist that they're back and on their way upstairs. You have two minutes, maybe three. And they're so mad they almost look like Firsters themselves!"

"Thanks. When they climb out of the elevator, do what you can without getting too illegal." He turned to his guests. "Listen—"

They had gone off again.

"Gabble, gabble, honk, honk, honk? Gabble, honk, *gabble,* gabble! Gabble, honk, gabble, honk, gabble, honk, honk."

Could they honestly make sense out of, these throat-clearings and half-sneezes? Was it really a language as superior to all previous languages of man as . . . as the Aliens were supposed to be to man himself? Well, at least they could communicate with the Aliens by means of it. And the Aliens, the Aliens—

He recollected abruptly the two angry representatives of the world state who were hurtling towards his office.

"Listen, friends. You came here to sell. You've shown me your stock, and I've seen something I'd like to buy. *What* exactly is immaterial. The only question now is what you want for it. And let's make it fast. I have some other business to transact."

The woman with the dental nightmare stamped her foot. A cloud no larger than a man's hand formed near the ceiling, burst and deposited a pailful of water on Hebster's fine custom-made rug.

He ran a manicured forefinger around the inside of his collar so that his bulging neck veins would not burst. Not right now, anyway. He looked at Greta and regained confidence from the serenity with which she waited for more conversation to transcribe. There was a model of business precision for you. The Primeys might pull what ofre of them had in London two years ago, before they were barred from all metropolitan areas—increased a housefly's size to that of an elephant—and Greta

Seidenheim would go on separating fragments of conversation into the appropriate shorthand symbols.

With all their power, why didn't they *take* what they wanted? Why trudge wearisome miles to cities and attempt to smuggle themselves into illegal audiences with operators like Hebster, when most of them were caught easily and sent back to the reservation and those that weren't were cheated unmercifully by the "straight" humans they encountered? Why didn't they just blast their way in, take their weird and pathetic prizes and toddle back to their masters? For that matter, why didn't their masters—But Primey psych was Primey psych—not for this world, nor of it.

"We'll tell you what we want in exchange," Larry began in the middle of a honk. He held up a hand on which the length of the fingernails was indicated graphically by the grime beneath them and began to tot up the items, bending a digit for each item. "First, a hundred paper-bound copies of Melville's 'Moby Dick'. Then, twenty-five crystal radio sets, with earphones; two earphones for each set. Then, two Empire State Buildings or three Radio Cities, whichever is more convenient. We want those with foundations intact. A reasonably good copy of the 'Hermes' statue by Praxiteles. And an electric toaster, *circa* 1941. That's about all, isn't it, Theseus?"

Theseus bent over until his nose rested against his knees.

Hebster groaned. The list wasn't as bad as he'd expected—remarkable the way their masters always yearned for the electric gadgets and artistic achievements of Earth—but he had so little time to bargain with them. *Two* Empire State Buildings!

"Mr. Hebster," his receptionist chattered over the communicator. "Those SIC men—I managed to get a crowd out in the corridor to push toward their elevator when it came to this floor, and I've locked the . . . I mean I'm trying to . . . but I don't think—Can you—"

"Good girl! You're doing fine!"

"Is that all we want, Theseus?" Larry asked again. "Gabble?"

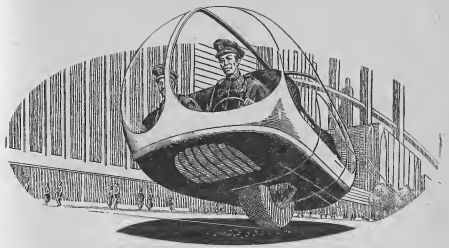
Hebster heard a crash in the outer office and footsteps running across the floor.

"See here, Mr. Hebster," Theseus said at last, "if you don't want to buy Larry's *reductio ad absurdum* exploder, and you don't like my method of decorating bald heads for all its innate artistry, how about a system of musical notation—"

Somebody tried Hebster's door, found it locked. There was a knock on the door, repeated most immediately with more urgency.

"He's *already* found something he wants," S.S. Lusitania snapped. "Yes, Larry, that was the complete list."

Hebster plucked a handful of hair from his already receding forehead. "Good! Now, look, I can give you everything but the two Empire State



Buildings and the three Radio Cities."

"*Or* the three Radio Cities," Larry corrected. "Don't try to cheat us! Two Empire State Buildings *or* three Radio Cities. Whichever is more convenient. Why . . . isn't it worth that to you?"

"Open this door!" a bull-mad voice yelled. "Open this door in the name of United Mankind!"

"Miss Seidenheim, open the door," Hebster said loudly and winked at his secretary who rose, stretched and began a thoughtful, slow-motion study in the direction of the locked panel. There was a crash as of a pair of shoulders being thrown against it. Hebster knew that his office door could withstand a medium-sized tank. But there was a limit even to delay when it came to fooling around with the UM Special Investigating Commission. Those boys knew their Primeys and their Primey-dealers; they were empowered to shoot first and ask questions afterwards—as the questions occurred to them.

"It's not a matter of whether it's worth my while," Hebster told them rapidly as he shepherded them to the exit behind his desk. "For reasons I'm sure you aren't interested in, I just can't give away two Empire State Buildings and/or three Radio Cities with foundations intact—not at the moment. I'll give you the rest of it, and—"

"Open this door or we start blasting it down!"

"Please, gentlemen, please," Greta Seidenheim told them sweetly. "You'll kill a poor working girl who's trying awfully hard to let you in. The lock's

stuck." She fiddled with the doorknob, watching Hebster with a trace of anxiety in her fine eyes.

"And to replace those items," Hebster was going on. "I will—"

"What I mean," Theseus broke in, "is this. You know the greatest single difficulty composers face in the twelve-tone technique?"

"I can offer you," the executive continued doggedly, sweat bursting out of his skin like spring freshets, "complete architectural blueprints of the Empire State Building and Radio City, plus five . . . no, I'll make it ten . . . scale models of each. And you get the rest of the stuff you asked for. That's it. Take it or leave it. Fast!"

They glanced at each other, as Hebster threw the exit door open and gestured to the five liveried bodyguards waiting near his private elevator. "*Done,*" they said in unison.

"Good!" Hebster almost squeaked. He pushed them through the doorway and said to the tallest of the five men: "Nineteenth floor!"

He slammed the exit shut just as Miss Seidenheim opened the outer office door. Yost and Funatti, in the bottle-green police uniform of the UM, charged through. Without pausing, they ran to where Hebster stood and plucked the exit open. They could all hear the elevator descending.

Funatti, a little, olive-skinned man, sniffed. "Primeys," he muttered. "He had Primeys here, all right. Smell that unwash, Yost?"

"Yeah," said the bigger man. "Come on. The emergency stairway. We can track that elevator!"

They holstered their service weapons and clattered down the metal-tipped stairs. Below, the elevator stopped.

Hebster's secretary was at the communicator. "Maintenance!" She waited. "Maintenance, automatic locks on the nineteenth floor exit until the party Mr. Hebster just sent down gets to a lab somewhere else. And keep apologizing to those cops until then. Remember, they're SIC."

"Thanks, Greta," Hebster said, switching to the personal now that they were alone. He plumped into his desk chair and blew out gustily: "There must be easier ways of making a million."

She raised two perfect blond eyebrows. "Or of being an absolute monarch right inside the parliament of man?"

"If they wait long enough," he told her lazily, "I'll *be* the UM, modern global government and all. Another year or two might do it."

"Aren't you forgetting one Vandermeer Dempsey? His huskies also want to replace the UM. Not to mention their colorful plans for you. And there are an awful, awful lot of them."

"They don't worry me, Greta. *Humanity First* will dissolve overnight once that decrepit old demagogue gives up the ghost." He stabbed at the communicator button. "Maintenance! Maintenance, that party I sent down arrived at a safe lab yet?"

"No, Mr. Hebster. But everything's going all right. We sent them up to the twenty-fourth floor and got the SIC men rerouted downstairs to the personnel levels. Uh, Mr. Hebster—about the SIC. We take your orders and all that, but none of us wants to get in trouble with the Special Investigating Commission. According to the latest laws, it's practically a capital offense to obstruct 'em."

"Don't worry," Hebster told him. "I've never let one of my employees down yet. The boss fixes everything is the motto here. Call me when you've got those Primeys safely hidden and ready for questioning."

He turned back to Greta. "Get that stuff typed before you leave and into Professor Kleimbocher's hands. He thinks he may have a new angle on their gabble-honk."

She nodded. "I wish you could use recording apparatus instead of making me sit over an old-fashioned click-box."

"So do I. But Primeys enjoy reaching out and putting a hex on electrical apparatus—when they aren't collecting it for the Aliens. I had a raft of wire and tape recorders busted in the middle of Primey interviews before I decided that human stenos were the only answer. And a Primey may get around to bollixing them some day."

"Cheerful thought. I must remember to dream about the possibility some cold night. Well, I should complain," she muttered as she went into her own little office, "Primey hexes built this business and pay my salary as well as supply me with the sparkling little knicknacks I love so well."

That was not quite true, Hebster remembered as he sat waiting for the communicator to buzz the news of his recent guests' arrival in a safe lab. Something like ninety-five per cent of Hebster Securities had been built out of Primey gadgetry extracted from them in various fancy deals, but the base of it all had been the small investment bank he had inherited from his father, back in the days of the Half-War—the days when the Aliens had first appeared on Earth.

The fearfully intelligent dots swirling in their variously shaped multicolored bottles were completely outside the pale of human understanding. There had been no way at all to communicate with them for a time.

A humorist had remarked back in those early days that the Aliens came not to bury man, not to conquer or enslave him. They had a truly dreadful mission—to ignore him!

No one knew, even today, what part of the galaxy the Aliens came from. Or why. No one knew what the total of their small visiting population came to. Or how they operated their wide-open and completely silent spaceships. The few things that had been discovered about them on the occasions when

they deigned to swoop down and examine some human enterprise, with the aloof amusement of the highly civilized tourist, had served to confirm a technological superiority over Man that strained and tore the capacity of his richest imagination. A sociological treatise Hebster had read recently suggested that they operated from concepts as far in advance of modern science as a meteorologist sowing a drought-struck area with dry ice was beyond the primitive agriculturist blowing a ram's horn at the heavens in a frantic attempt to wake the slumbering gods of rain.

Prolonged, infinitely dangerous observation had revealed, for example, that the dots-in-bottles seemed to have developed past the need for prepared tools of any sort. They worked directly on the material itself, shaping it to need, evidently creating and destroying matter at will!

Some humans had communicated with them—

They didn't stay human.

Men with superb brains had looked into the whirring, flickering settlements established by the outsiders. A few had returned with tales of wonders they had realized dimly and not quite seen. Their descriptions always sounded as if their eyes had been turned off at the most crucial moments or a mental fuse had blown just this side of understanding.

Others—such celebrities as a President of Earth, a three-time winner of the Nobel Prize, famous poets—had evidently broken through the fence somehow. These, however, were the ones who didn't return. They stayed in the Alien settlements in the Gobi, the Sahara, the American Southwest. Barely able to fend for themselves, despite newly-acquired and almost unbelievable powers, they shambled worshipfully around the outsiders speaking, with weird writhings of larynx and nasal passage, what was evidently a human approximation of their masters' language—a kind of pidgin Alien. Talking with a Primey, someone had said, was like a blind man trying to read a page of Braille originally written for an octopus.

And that these bearded, bug-ridden, stinking derelicts, these chattering wrecks drunk and sodden on the logic of an entirely different life-form, were the heavy yellow cream of the human race didn't help people's egos any.

Humans and Primeys despised each other almost from the first; humans for Primey subservience and helplessness in human terms, Primeys for human ignorance and ineptness in Alien terms. And, except when operating under Alien orders and through barely legal operators like Hebster, Primeys didn't communicate with humans any more than their masters did.

When institutionalized, they either gabble-honked themselves into an early grave or, losing patience suddenly, they might dissolve a path to freedom right through the walls of the asylum and any attendants who chanced to be in the way. Therefore the enthusiasm of sheriff and deputy, nurse and orderly, had waned considerably and the forcible incarceration of Primeys had almost ceased.

Since the two groups were so far apart psychologically as to make mating between them impossible, the ragged miracle-workers had been honored with the status of a separate classification:

Humanity Prime. Not better than humanity, not necessarily worse—but different, and dangerous.

What made them that way? Hebster rolled his chair back and examined the hole in the floor from which the alarm spring had spiraled. Theseus had disintegrated it—*how?* With a thought? Telekinesis, say, applied to all the molecules of the metal simultaneously, making them move rapidly and at random. Or possibly he had merely moved the spring somewhere else. Where? In space? In hyperspace? In time? Hebster shook his head and pulled himself back to the efficiently smooth and sanely useful desk surface.

"Mr. Hebster?" the communicator inquired abruptly, and he jumped a bit, "this is Margritt of General Lab 23B. Your Primeys just arrived. Regular check?"

Regular check meant drawing them out on every conceivable technical subject by the nine specialists in the general laboratory. This involved firing questions at them with the rapidity of a police interrogation, getting them off balance and keeping them there in the hope that a useful and unexpected bit of scientific knowledge would drop.

"Yes," Hebster told him. "Regular check. But first let a textile man have a whack at them. In fact let him take charge of the check."

A pause. "The only textile man in this section is Charlie Verus."

"Well?" Hebster asked in mild irritation. "Why put it like that? He's competent I hope. What does personnel say about him?"

"Personnel says he's competent."

"Then there you are. Look, Margritt, I have the SIC running around my building with blood in its enormous eye. I don't have time to muse over your departmental feuds. Put Verus on."

"Yes, Mr. Hebster. Hey Bert! Get Charlie Verus. Him."

Hebster shook his head and chuckled. These technicians! Verus was probably brilliant and nasty.

The box crackled again: "Mr. Hebster? Mr. Verus." The voice expressed boredom to the point of obvious affectation. But the man was probably good despite his neuroses. Hebster Securities, Inc., had a first-rate personnel department.

"Verus? Those Primeys, I want you to take charge of the check. One of them knows how to make a synthetic fabric with the drape of silk. Get that first and then go after anything else

they have."

"Primeys, Mr. Hebster?"

"I said Primeys, Mr. Verus. You are a textile technician, please to remember, and not the straight or ping-pong half of a comedy routine. Get humping. I want a report on that synthetic fabric by tomorrow. Work all night if you have to."

"Before we do, Mr. Hebster, you might be interested in a small piece of information. There is *already* in existence a synthetic which falls better than silk—"

"I know," his employer told him shortly. "Cellulose acetate. Unfortunately, it has a few disadvantages: low melting-point, tends to crack; separate and somewhat inferior dyestuffs have to be used for it; poor chemical resistance. Am I right?"

There was no immediate answer, but Hebster could feel the dazed nod. He went on. "Now, we also have protein fibers. They dye well and fall well, have the thermoconductivity control necessary for wearing apparel, but don't have the tensile strength of synthetic fabrics. An *artificial* protein fiber might be the answer: it would drape as well as silk, might be we could use the acid dyestuffs we use on silk which result in shades that dazzle female customers and cause them to fling wide their pocketbooks. There are a lot of *ifs* in that, I know, but one of those Primeys said something about a synthetic with the drape of silk, and I don't think he'd be sane enough to be referring to cellulose acetate. Nor nylon, orlon, vinyl chloride, or anything else we already have and use."

"You've looked into textile problems, Mr. Hebster."

"I have. I've looked into everything to which there are big gobs of money attached. And now suppose you go look into those Primeys. Several million women are waiting breathlessly for the secrets concealed in their beards. Do you think, Verus, that with the personal and scientific background I've just given you it's possible you might now get around to doing the job you are paid to do?"

"Um-m-m. Yes."

Hebster walked to the office closet and got his hat and coat. He liked working under pressure; he liked to see people jump up straight whenever he barked. And now, he liked the prospect of relaxing.

He grimaced at the webfoam chair that Larry had used. No point in having it resquirted. Have a new one made.

"I'll be at the University," he told Ruth on his way out. "You can reach me through Professor Kleimbocher. But don't, unless it's very important. He gets unpleasantly annoyed when he's interrupted."

She nodded. Then, very hesitantly: "Those two men—Yost and Funatti—from the Special Investigating Commission? They said no one would be allowed to leave the building."

"Did they now?" he chuckled. "I think they were angry. They've been that way before. But unless and until they can hang something on me—And Ruth, tell my bodyguard to go home, except for the man with the Primeys. He's to check with me, wherever I am, every two hours."

He ambled out, being careful to smile benevolently at every third executive and fifth typist in the large office. A private elevator and entrance was all very well for an occasional crisis, but Hebster liked to taste his successes in as much public as possible.

It would be good to see Kleimbocher again. He had a good deal of faith in the linguistic approach; grants from his corporation had tripled the size of the university's philology department. After all, the basic problem between man and Primey as well as man and Alien was one of communication. Any attempt to learn their science, to adjust their mental processes and logic into safer human channels, would have to be preceded by understanding.

It was up to Kleimbocher to find that understanding, not him. "I'm Hebster," he thought. "I *employ* the people who solve problems. And then I make money off them."

Somebody got in front of him. Somebody else took his arm. "I'm Hebster," he repeated automatically, but out loud. "*Algernon* Hebster."

"Exactly the Hebster we want," Funatti said holding tightly on to his arm. "You don't mind coming along with us?"

"Is this an arrest?" Hebster asked the larger Yost who now moved aside to let him pass. Yost was touching his holstered weapon with dancing fingertips.

The SIC man shrugged. "Why ask such questions?" he countered. "Just come along and be sociable, kind of. People want to talk to you."

He allowed himself to be dragged through the lobby ornate with murals by radical painters and nodded appreciation at the doorman who, staring right through his captors, said enthusiastically, "Good *afternoon*, Mr. Hebster." He made himself fairly comfortable on the back seat of the dark-green SIC car, a late model Hebster Monowheel.

"Surprised to see you minus your bodyguard." Yost, who was driving, remarked over his shoulder.

"Oh, I gave them the day off."

"As soon as you were through with the Primeys? No," Funatti admitted, "we never did find out where you cached them. That's one big building you own, mister. And the UM Special Investigating Commission is notoriously understaffed."

"Not forgetting it's also notoriously underpaid," Yost broke in.

"I couldn't forget that if I tried," Funatti assured him. "You know, Mr. Hebster, I wouldn't have sent my bodyguard off if I'd been in your shoes. Right now there's something about five times as dangerous as Primeys

after you. I mean Humanity Firsters."

"Vandermeer Dempsey's crackpots? Thanks, but I think I'll survive."

"That's all right. Just don't give any long odds on the proposition. Those people have been expanding fast and furious. *The Evening Humanitarian* alone has a tremendous circulation. And when you figure their weekly newspapers, their penny booklets and throwaway handbills, it adds up to an impressive amount of propaganda. Day after day they bang away editorially at the people who're making money off the Aliens and Primeys. Of course, they're really hitting at the UM, like always, but if an ordinary Firster met you on the street, he'd be as likely to cut your heart out as not. Not interested? Sorry. Well, maybe you'll like this. *The Evening Humanitarian* has a cute name for you."

Yost guffawed. "Tell him, Funatti."

The corporation president looked at the little man inquiringly.

"They call you," Funatti said with great savoring deliberation, "they call you an interplanetary pimp!"

Emerging at last from the crosstown underpass, they sped up the very latest addition to the strangling city's facilities—the East Side Air-Floating Super-Duper Highway, known familiarly as Dive-Bomber Drive. At the Forty-Second Street offway, the busiest road exit in Manhattan, Yost failed to make a traffic signal. He cursed absent-mindedly and Hebster found himself nodding the involuntary passenger's agreement. They watched the elevator section dwindling downward as the cars that were to mount the highway spiraled up from the right. Between the two, there rose and fell the steady platforms of harbor traffic while, stacked like so many decks of cards, the pedestrian stages awaited their turn below.

"Look! Up there, straight ahead! See it?"

Hebster and Funatti followed Yost's long, waggling forefinger with their eyes. Two hundred feet north of the offway and almost a quarter of a mile straight up, a brown object hung in obvious fascination. Every once in a while a brilliant blue dot would enliven the heavy murk imprisoned in its bell-jar shape only to twirl around the side and be replaced by another.

"Eyes? You think they're eyes?" Funatti asked, rubbing his small dark fists against each other futilely. "I know what the scientists say—that every dot is equivalent to one person and the whole bottle is like a family or a city, maybe. But how do they know? It's a theory, a guess. *I* say they're eyes."

Yost hunched his great body half out of the open window and shaded his vision with his uniform cap against the sun. "Look at it," they heard him say, over his shoulder. A nasal twang, long-buried, came back into his voice as heaving emotion shook out its cultivated accents. "A-setting up there, a-staring and a-staring. So all-fired interested in how we get on and off a busy highway! Won't pay us no never mind when we try to talk to it, when we try to find out what it wants, where it comes from, who it is. Oh, no! It's too superior to talk to the likes of us! But it can watch us, hours on end, days without end, light and dark, winter and summer; it can watch us going about our business; and every time we dumb two-legged animals try to do something *we* find complicated, along comes a blasted 'dots-in-bottle' to watch and sneer and—"

"Hey there, man," Funatti leaned forward and tugged at his partner's green jerkin. "Easy! We're SIC, on business."

"All the same," Yost grunted wistfully, as he plopped back into his seat and pressed the power button, "I wish I had Daddy's little old M-1 Garand right now." They bowled forward, smoothed into the next long elevator section and started to descend. "It would be worth the risk of getting *pinged*."

And this was a UM man, Hebster reflected with acute discomfort. Not only UM, at that, but member of a special group carefully screened for their lack of anti-Primey prejudice, sworn to enforce the reservation laws without discrimination and dedicated to the proposition that Man could somehow achieve equality with Alien.

Well, how much dirt-eating could people do? People without a business sense, that is. His father had hauled himself out of the pick-and-shovel brigade hand over hand and raised his only son to maneuver always for greater control, to search always for that extra percentage of profit.

But others seemed to have no such abiding interest, Algernon Hebster knew regretfully.

They found it impossible to live with achievements so abruptly made inconsequential by the Aliens. To know with certainty that the most brilliant strokes of which they were capable, the most intricate designs and clever careful workmanship, could be duplicated—and surpassed—in an instant's creation by the outsiders and was of interest to them only as a collector's item. The feeling of inferiority is horrible enough when imagined; but when it isn't feeling but *knowledge*, when it is inescapable and thoroughly demonstrable, covering every aspect of constructive activity, it becomes unbearable and maddening.

No wonder men went berserk under hours of unwinking Alien scrutiny—watching them as they marched in a colorfully uniformed lodge parade, or fished through a hole in the ice, as they painfully maneuvered a giant transcontinental jet to a noiseless landing or sat in sweating, serried rows chanting to a single, sweating man to "knock it out of the park and sew the whole thing up!" No wonder they seized rusty shotgun or gleaming rifle and sped shot after vindictive shot

into a sky poisoned by the contemptuous curiosity of a brown, yellow or vermillion "bottle."

Not that it made very much difference. It did give a certain release to nerves backed into horrible psychic corners. But the Aliens didn't notice, and that was most important. The Aliens went right on watching, as if all this shooting and uproar, all these imprecations and weapon-wavings, were all part of the self-same absorbing show they had paid to witness and were determined to see through if for nothing else than the occasional amusing fluff some member of the inexperienced cast might commit.

The Aliens weren't injured, and the Aliens didn't feel attacked. Bullets, shells, buckshot, arrows, pebbles from a slingshot—all Man's miscellany of anger passed through them like the patient and eternal rain coming in the opposite direction. Yet the Aliens had solidity somewhere in their strange bodies. One could judge that by the way they intercepted light and heat. And also—

Also by the occasional *ping*.

Every once in a while, someone would evidently have hurt an Alien slightly. Or more probably just annoyed it by some unknown concomitant of rifle-firing or javelin-throwing.

There would be the barest suspicion of a sound—as if a guitarist had lunged at a string with his fingertip and decided against it one motor impulse too late. And, after this delicate and hardly-heard *ping*, quite unspectacularly, the rifleman would be weaponless. He would be standing there sighting stupidly up along his empty curled fingers, elbow cocked out and shoulder hunched in, like a large oafish child who had forgotten when to end the game. Neither his rifle nor a fragment of it would ever be found. And—gravely, curiously, intently—the Alien would go on watching.

The *ping* seemed to be aimed chiefly at weapons. Thus, occasionally, a 155 mm. howitzer was *ping*ed, and, also occasionally, unexpectedly, it might be a muscular arm, curving back with another stone, that would disappear to the accompaniment of a tiny elfin note. And yet sometimes—could it be that the Alien, losing interest, had become careless in its irritation?—the entire man, murderously violent and shrieking, would *ping* and be no more.

It was not as if a counter-weapon were being used, but a thoroughly higher order of reply, such as a slap to an insect bite. Hebster, shivering, recalled the time he had seen a black tubular Alien swirl its amber dots over a new substreet excavation, seemingly entranced by the spectacle of men scrabbling at the earth beneath them.

A red-headed Sequoia of Irish labor had looked up from Manhattan's stubborn granite just long enough to shake the sweat from his eyelids. So doing, he had caught sight of the dot-pulsing observer and paused to snarl and lift his pneumatic drill, rattling it in noisy, if functionless, bravado at the sky. He had hardly been noticed by his mates, when the long, dark, speckled representative of a race beyond the stars turned end over end once and *ping*ed.

The heavy drill remained upright for a moment, then dropped as if it had abruptly realized its master was gone. Gone? Almost, he had never been. So thorough had his disappearance been, so rapid, with so little flicker had he been snuffed out—harming and taking with him nothing else—that it had amounted to an act of gigantic and positive noncreation.

No, Hebster decided, making threatening gestures at the Aliens was suicidal. Worse, like everything else that had been tried to date, it was useless. On the other hand, wasn't the *Humanity First* approach a complete neurosis? What *could* you do?

He reached into his soul for an article of fundamental faith, found it. "I can make money," he quoted to himself. "That's what I'm good for. That's what I can always do."

As they spun to a stop before the dumpy, brown-brick armory that the SIC had appropriated for its own use, he had a shock. Across the street was a small cigar store, the only one on the block. Brand names which had decorated the plate-glass window in all the colors of the copyright had been supplanted recently by great gilt slogans. Familiar slogans they were by now—but this close to a UM office, the Special Investigating Commission itself?

At the top of the window, the proprietor announced his affiliation in two huge words that almost screamed their hatred across the street:

HUMANITY FIRST!

Underneath these, in the exact center of the window, was the large golden initial of the organization, the wedded letters HF arising out of the huge, symbolic safety razor.

And under that, in straggling script, the theme repeated, reworded and sloganized:

"*Humanity first, last and all the time!*"

The upper part of the door began to get nasty:

"*Deport the Aliens! Send them back to wherever they came from!*"

And the bottom of the door made the store-front's only concession to business:

"*Shop here! Shop Humanitarian!*"

"*Humanitarian!*" Funatti nodded bitterly beside Hebster. "Ever see what's left of a Primey if a bunch of Firsters catch him without SIC protection? Just about enough to pick up with a blotter. I don't imagine you're too happy about boycott-shops like that?"

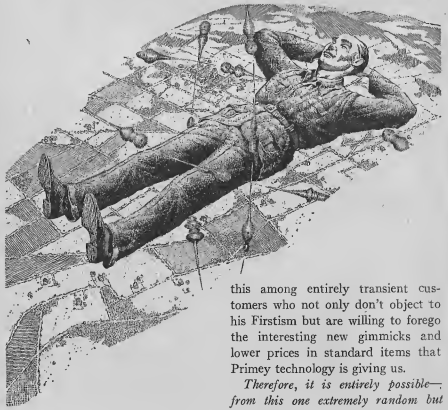
Hebster managed a chuckle as they walked past the saluting, green-uniformed guards. "There aren't very many Primey-inspired gadgets having

to do with tobacco. And if there were, one *Shop Humanitarian* outfit isn't going to break me."

But it is, he told himself disconsolately. It is going to break me—if it means what it seems to. Organization membership is one thing and so is planetary patriotism, but business is something else.

Hebster's lips moved slowly, in half-remembered catechism: Whatever the proprietor believes in or does not believe in, he has to make a certain amount of money out of that place if he's going to keep the door free of bailiff stickers. He can't do it if he offends the greater part of his possible clientele.

Therefore, since he's still in business and, from all outward signs, doing quite well, it's obvious that he doesn't have to depend on across-the-street UM personnel. Therefore, there must be a fairly substantial trade to offset



this among entirely transient customers who not only don't object to his Firstism but are willing to forego the interesting new gimmicks and lower prices in standard items that Primey technology is giving us.

Therefore, it is entirely possible—from this one extremely random but highly significant sample—that the newspapers I read have been lying and the socio-economists I employ are incompetent. It is entirely possible that the buying public, the only aspect of the public in which I have the slightest interest, is beginning a shift in general viewpoint which will profoundly affect its purchasing orientation.

It is possible that the entire UM economy is now at the top of a long slide into Humanity First domination, the secure zone of fanatic blindness demarcated by men like Vandermeer Dempsey. The highly usurious, commercially speculative economy of Imperial Rome made a similar transition in the much slower historical pace of two millennia ago and became, in three brief centuries, a static unbusinesslike world in which banking was a sin and wealth which had not been inherited was gross and dishonorable.

Meanwhile, people may already have begun to judge manufactured items on the basis of morality instead of usability, Hebster realized, as dim mental notes took their stolid place beside forming conclusions. He remembered a folderful of brilliant explanation Market Research had sent up last week dealing with unexpected consumer resistance to the new Evvakleen dishware. He had dismissed the pages of carefully developed thesis—to the effect that women were unconsciously associating the product's name with a certain Katherine Evvakios who had recently made the front page of every tabloid in the world by dint of some fast work with a breadknife on the throats of her five children and two lovers—with a yawning smile after examining its first brightly colored chart.

"Probably nothing more than normal housewifely suspicion of a radically new idea," he had muttered, "after washing dishes for years, to be told it's no longer necessary! She can't believe her Evvakleen dish is still the same after stripping the outermost film of molecules after a meal. Have to hit that educational angle a bit harder—maybe tie it in with the expendable molecules lost by the skin during a shower."

He'd penciled a few notes on the margin and flipped the whole problem onto the restless lap of Advertising and Promotion.

But then there had been the seasonal slump in furniture—about a month ahead of schedule. The surprising lack of interest in the Hebster Chubbichair, an item which should have revolutionized men's sitting habits.

Abruptly, he could remember almost a dozen unaccountable disturbances in the market recently, and all in consumer goods. That fits, he decided; any change in buying habits wouldn't be reflected in heavy industry for at least a year. The machine tools plants would feel it before the steel mills; the mills before the smelting and refining combines; and the

banks and big investment houses would be the last of the dominoes to topple.

With its capital so thoroughly tied up in research and new production, his business wouldn't survive even a temporary shift of this type. Hebster Securities, Inc. could go like a speck of lint being blown off a coat collar.

Which is a long way to travel from a simple little cigar store. Funatti's jitters about growing Firstist sentiment are contagious! he thought.

If only Kleimbocher could crack the communication problem! If we could talk to the Aliens, find some sort of place for ourselves in their universe. The Firsters would be left without a single political leg!

Hebster realized they were in a large, untidy, map-spattered office and that his escort was saluting a huge, even more untidy man who waved their hands down impatiently and nodded them out of the door. He motioned Hebster to a choice of seats. This consisted of several long walnut-stained benches scattered about the room.

P. Braganza, said the desk nameplate with ornate Gothic flow. P. Braganza had a long, twirlable and tremendously thick mustache. Also, P. Braganza needed a haircut badly. It was as if he and everything in the room had been carefully designed to give the maximum affront to Humanity Firsters. Which, considering their crew-cut, closely-shaven, "Cleanliness is next to Manliness" philosophy, meant that there was a lot of gratuitous unpleasantness in this office when a raid on a street demonstration filled it with jostling fanatics, antiseptically clean and dressed with bare-bone simplicity and neatness.

"So you're worrying about Firster effect on business?"

Hebster looked up, startled.

"No, I don't read your mind," Braganza laughed through tobacco-stained teeth. He gestured at the window behind his desk. "I saw you jump just the littlest bit when you noticed that cigar store. And then you stared at it for two full minutes. I knew what you were thinking about."

"Extremely perceptive of you," Hebster remarked dryly.

The SIC official shook his head in a violent negative. "No, it wasn't. It wasn't a bit perceptive. I knew what you were thinking about because I sit up here day after day staring at that cigar store and thinking exactly the same thing. Braganza, I tell myself, that's the end of your job. That's the end of scientific world government. Right there on that cigar-store window."

He glowered at his completely littered desk top for a moment. Hebster's instincts woke up— there was a sales talk in the wind. He realized the man was engaged in the unaccustomed exercise of looking for a conversational gambit. He felt an itch of fear crawl up

his intestines. Why should the SIC, whose power was almost above law and certainly above governments, be trying to dicker with him?

Considering his reputation for asking questions with the snarling end of a rubber hose, Braganza was being entirely too gentle, too talkative, too friendly. Hebster felt like a trapped mouse into whose disconcerted ear a cat was beginning to pour complaints about the dog upstairs.

"Hebster, tell me something. What are your goals?"

"I beg your pardon?"

"What do you want out of life? What do you spend your days planning for, your nights dreaming about? Yost likes the girls and wants more of them. Funatti's a family man, five kids. He's happy in his work because his job's fairly secure, and there are all kinds of pensions and insurance policies to back up his life."

Braganza lowered his powerful head and began a slow, reluctant pacing in front of the desk.

"Now, I'm a little different. Not that I mind being a glorified cop. I appreciate the regularity with which the finance office pays my salary, of course; and there are very few women in this town who can say that I have received an offer of affection from them with outright scorn. But the one thing for which I would lay down my life is United Mankind. *Would* lay down my life? In terms of blood pressure and heart strain you might say I've already done it! Braganza, I tell myself, you're a lucky dope. You're working for the first world government in human history. Make it count."

He stopped and spread his arms in front of Hebster. His unbuttoned green jerkin came apart awkwardly and exposed the black slab of hair on his chest. "That's me. That's basically all there is to Braganza. Now if we're to talk sensibly I have to know as much about you. I ask—what are your goals?"

The President of Hebster Securities, Inc., wet his lips. "I'm afraid I'm even less complicated."

"That's all right," the other man encouraged. "Put it any way you like."

"You might say that before everything else I am a businessman. I am interested chiefly in becoming a better businessman, which is to say a bigger one. In other words, I want to be richer than I am."

Braganza peered at him intently. "And that's all?"

"All? Haven't you ever heard it said that money isn't everything, but that what it isn't it can buy?"

"It can't buy me."

Hebster examined him coolly. "I don't know if you're a sufficiently desirable commodity. I buy what I need, only occasionally making an exception to please myself."

"I don't like you." Braganza's voice had become thick and ugly. "I

never liked your kind and there's no sense being polite. I might as well stop trying. I tell you straight out—I think your guts stink."

Hebster rose. "In that case, I believe I should thank you for—"

"Sit *down*! You were asked here for a reason. I don't see any point to it, but we'll go through the motions. Sit down."

Hebster sat. He wondered idly if Braganza received half the salary he paid Greta Seidenheim. Of course, Greta was talented in many different ways and performed several distinct and separately useful services. No, after tax and pension deductions, Braganza was probably fortunate to receive one third of Greta's salary.

He noticed that a newspaper was being proffered him. He took it. Braganza grunted, clumped back behind his desk and swung his swivel chair around to face the window.

It was a week-old copy of *The Evening Humanitarian*. The paper had lost the "voice-of-a-small-but-highly-articulate-minority" look, Hebster remembered from his last reading of it, and acquired the feel of publishing big business. Even if you cut in half the circulation claimed by the box in the upper left-hand corner, that still gave them three million paying readers.

In the upper right-hand corner, a red-bordered box exhorted the faithful to "*Read Humanitarian!*" A green streamer across the top of the first page announced that "*Making sense is human—to gibber, Prime!*"

But the important item was in the middle of the page. A cartoon.

Half-a-dozen Primeys wearing long, curved beards and insane, tongue-lolling grins, sat in a rickety wagon. They held reins attached to a group of straining and portly gentlemen dressed —somewhat simply—in high silk hats. The fattest and ugliest of these, the one in the lead, had a bit between his teeth. The bit was labeled "*crazy-money*" and the man, "Algernon Hebster."

Crushed and splintering under the wheels of the wagon were such varied items as a "Home Sweet Home" framed motto with a piece of wall attached, a clean-cut youngster in a Boy Scout uniform, a streamlined locomotive and a gorgeous young woman with a squalling infant under each arm.

The caption inquired starkly: "Lords of Creation—Or *Serfs*?"

"This paper seems to have developed into a fairly filthy scandal sheet," Hebster mused out loud. "I shouldn't be surprised if it makes money."

"I take it then," Braganza asked without turning around from his contemplation of the street, "that you haven't read it very regularly in recent months?"

"I am happy to say I have not."

"That was a mistake."

Hebster stared at the clumped locks of black hair. "Why?" he asked carefully.

"Because it *has* developed into a thoroughly filthy and extremely successful scandal sheet. You're its chief scandal." Braganza laughed. "You see these people look upon Primey dealing as more of a sin than a crime. And, according to that morality, you're close to Old Nick himself!"

Shutting his eyes for a moment, Hebster tried to understand people who imagined such a soul-satisfying and beautiful concept as profit to be a thing of dirt and crawling maggots. He sighed. "I've thought of Firstism as a religion myself."

That seemed to get the SIC man. He swung around excitedly and pointed with both forefingers. "I tell you that you are right! It crosses all boundaries —incompatible and warring creeds are absorbed into it. It is willful, witless denial of a highly painful fact—that there are intellects abroad in the universe which are superior to our own. And the denial grows in strength every day that we are unable to contact the Aliens. If, as seems obvious, there is no respectable place for humanity in this galactic civilization, why, say men like Vandermeer Dempsey, then let us preserve our self-conceit at the least. Let's stay close to and revel in the things that are undeniably human. In a few decades, the entire human race will have been sucked into this blinkered vacuum."

He rose and walked around the desk again. His voice had assumed a terribly earnest, tragically pleading quality. His eyes roved Hebster's face as if searching for a pin-point of weakness, an especially thin spot in the frozen calm.

"Think of it," he asked Hebster. "Periodic slaughters of scientists and artists who, in the judgment of Dempsey, have pushed out too far from the conventional center of so-called humanness. An occasional *auto-da-fé* in honor of a merchant caught selling Primey goods—"

"I shouldn't like that," Hebster admitted, smiling. He thought a moment. "I see the connection you're trying to establish with the cartoon in *The Evening Humanitarian*."

"Mister, I shouldn't have to. They want your head on the top of a long stick. They want it because you've become a symbol of dealing successfully for your own ends, with these stellar foreigners, or at least their human errand-boys and chambermaids. They figure that maybe they can put a stop to Primey-dealing generally if they put a bloody stop to you. And I tell you this—maybe they are right."

"What exactly do you propose?" Hebster asked in a low voice.

"That you come in with us. We'll make an honest man of you—officially. We want you directing our investigation; except that the goal will not be an extra buck but all-important interracial communication and eventual interstellar negotiation."

The president of Hebster Securities,

Inc. gave himself a few minutes on that one. He wanted to work out a careful reply. And he wanted time—above all, he wanted time!

He was so close to a well-integrated and world-wide commercial empire! For ten years, he had been carefully fitting the component industrial kingdoms into place, establishing suzerainty in this production network and squeezing a little more control out of that economic satrapy. He had found delectable tidbits of power in the dissolution of his civilization, endless opportunities for wealth in the shards of his race's self-esteem. He required a bare twelve months now to consolidate and co-ordinate. And suddenly—with the open-mouthed shock of a Jim Fiske who had cornered gold on the Exchange only to have the United States Treasury defeat him by releasing enormous quantities from the Government's own hoard—suddenly, Hebster realized he wasn't going to have the time. He was too experienced a player not to sense that a new factor was coming into the game, something outside his tables of actuarial figures, his market graphs and cargo loading indices.

His mouth was clogged with the heavy nausea of unexpected defeat. He forced himself to answer:

"I'm flattered. Braganza, I *really* am flattered. I see that Dempsey has linked us—we stand or fall together. But—I've always been a loner. With whatever help I can buy, I take care of myself. I'm not interested in any goal but the extra buck. First and last, I'm a businessman."

"Oh, stop it!" the dark man took a turn up and down the office angrily. "This is a planet-wide emergency. There are times when you can't be a businessman."

"I deny that. I can't conceive of such a time."

Braganza snorted. "You can't be a businessman if you're strapped to a huge pile of blazing faggots. You can't be a businessman if people's minds are so thoroughly controlled that they'll stop eating at their leader's command. You can't be a businessman, my slavering, acquisitive friend, if demand is so well in hand that it ceases to exist."

"That's impossible!" Hebster had leaped to his feet. To his amazement, he heard his voice climbing up the scale to hysteria. "There's *always* demand. Always! The trick is to find what new form it's taken and then fill it!"

"Sorry! I didn't mean to make fun of your religion."

Hebster drew a deep breath and sat down with infinite care. He could almost feel his red corpuscles simmering.

Take it easy, he warned himself, take it easy! This is a man who must be won, not antagonized. They're changing the rules of the market, Hebster, and you'll need every friend you can buy.

Money won't work with this fellow.

But there are *other* values—

"Listen to me, Braganza. We're up against the psycho-social consequences of an extremely advanced civilization hitting a comparatively barbarous one. Are you familiar with Professor Kleimbocher's Firewater Theory?"

"That the Alien's logic hits us mentally in the same way as whisky hit the North American Indian? And the Primeys, representing our finest minds, are the equivalent of those Indians who had the most sympathy with the white man's civilization? Yes. It's a strong analogy. Even carried to the Indians who, lying sodden with liquor in the streets of frontier towns, helped create the illusion of the treacherous, lazy, kill-you-for-a-drink aborigines while being so thoroughly despised by their tribesmen that they didn't dare go home for fear of having their throats cut. I've always felt—"

"The only part of that I want to talk about," Hebster interrupted, "is the firewater concept. Back in the Indian villages, an ever-increasing majority became convinced that firewater and gluttonous paleface civilization were synonymous, that they must rise and retake their land forcibly, killing in the process as many drunken renegades as they came across. This group can be equated with the Humanity Firsters. Then there was a minority who recognized the white man's superiority in numbers and weapons, and desperately tried to find a way of coming to terms with his civilization—terms that would not include his booze. For them read the UM. Finally, there was my kind of Indian."

Braganza knitted voluminous eyebrows and hitched himself up to a corner of the desk. "Hah?" he inquired. "What kind of Indian were *you*, Hebster?"

"The kind who had enough sense to know that the paleface had not the slightest interest in saving him from slow and painful cultural anemia. The kind of Indian, also, whose instincts were sufficiently sound so that he was scared to death of innovations like firewater and wouldn't touch the stuff to save himself from snake bite. But the kind of Indian—"

"Yes? Go on!"

"The kind who was fascinated by the strange transparent container in which the firewater came! Think how covetous an Indian potter might be of the whisky bottle, something which was completely outside the capacity of his painfully acquired technology. Can't you see him hating, despising and terribly afraid of the smelly amber fluid, which toppled the most stalwart warriors, yet wistful to possess a bottle minus contents? That's about where I see myself, Braganza—the Indian whose greedy curiosity shines through the murk of hysterical clan politics and outsiders' contempt like a lambent flame. I want the new kind of container somehow separated from the firewater."

Unblinkingly, the great dark eyes stared at his face. A hand came up and smoothed each side of the arched mustachio with long, unknowing twirls. Minutes passed.

"Well. Hebster as our civilization's noble savage," the SIC man chuckled at last, "it almost feels right. But what does it mean in terms of the overall problem?"

"I've told you," Hebster said wearily, hitting the arm of the bench with his open hand, "that I haven't the slightest interest in the overall problem."

"And you only want the bottle. I heard you. But you're not a potter, Hebster—you haven't an elementary particle of craftsman's curiosity. All of that historical romance you spout—you don't care if your world drowns in its own agonized juice. You just want a profit."

"I never claimed an altruistic reason. I leave the general solution to men whose minds are good enough to juggle its complexities—like Kleimbocher."

"Think somebody like Kleimbocher could do it?"

"I'm almost certain he will. That was our mistake from the beginning—trying to break through with historians and psychologists. Either they've become limited by the study of human societies or—well, this is personal, but I've always felt that the science of the mind attracts chiefly those who've already experienced grave psychological difficulty. While they might achieve such an understanding of themselves in the course of their work as to become better adjusted eventually than individuals who had less problems to begin with, I'd still consider them too essentially unstable for such an intrinsically shocking experience as establishing *rapport* with an Alien. Their internal dynamics inevitably make Primeys of them."

Braganza sucked at a tooth and considered the wall behind Hebster. "And all this, you feel, wouldn't apply to Kleimbocher?"

"No, not a philology professor. He has no interest, no intellectual roots in personal and group instability. Kleimbocher's a comparative linguist—a technician, really—a specialist in basic communication. I've been out to the university and watched him work. His approach to the problem is entirely in terms of his subject—communicating with the Aliens instead of trying to understand them. There's been entirely too much intricate speculation about Alien consciousness, sexual attitudes and social organization, about stuff from which we will derive no tangible and immediate good. Kleimbocher's completely pragmatic."

"All right. I follow you. Only he went Prime this morning."

Hebster paused, a sentence dangling from his dropped jaw. "Professor Kleimbocher? *Rudolf* Kleimbocher?" he asked idiotically. "But he was so close . . . he almost had it . . . an elementary signal dictionary . . . he was about to—"

"He *did*. About nine forty-five. He'd been up all night with a Primey one of the psych professors had managed to hypnotize and gone home unusually optimistic. In the middle of his first class this morning, he interrupted himself in a lecture on medieval cyrillic to . . . to gabble-honk. He sneezed and wheezed at the students for about ten minutes in the usual Primey pattern of initial irritation, then, abruptly giving them up as hopeless, worthless idiots, he levitated himself in that eerie way they almost always do at first. Banged his head against the ceiling and knocked himself out. I don't know what it was, fright, excitement, respect for the old boy perhaps, but the students neglected to tie him up before going for help. By the time they'd come back with the campus SIC man, Kleimbocher had revived and dissolved one wall of the Graduate School to get out. Here's a snapshot of him about five hundred feet in the air, lying on his back with his arms crossed behind his head, skimming west at twenty miles an hour."

The executive studied the little paper rectangle with blinking eyes. "You radioed the air force to chase him, of course."

"What's the use? We've been through *that* enough times. He'd either increase his speed and generate a tornado, drop like a stone and get himself smeared all over the countryside or materialize stuff like wet coffee grounds and gold ingots inside the jets of the pursuing plane. Nobody's caught a Primey yet in the first flush of . . . whatever they do feel at first. And we might stand to lose anything from a fairly expensive hunk of aircraft, including pilot, to a couple of hundred acres of New Jersey topsoil."

Hebster groaned. "But the eighteen years of research that he represented!"

"Yeah. That's where we stand. Blind Alley umpteen hundred thousand or thereabouts. Whatever the figure is, it's awfully close to the end. If you can't crack the Alien on a straight linguistic basis, you can't crack the Alien at all, period, end of paragraph. Our most powerful weapons affect them like bubble pipes, and our finest minds are good for nothing better than to serve them in low, fawning idiocy. But the Primeys are all that's left. We might be able to talk sense to the Man if not the Master."

"Except that Primeys, by definition, don't talk sense."

Braganza nodded. "But since they were human—*ordinary* human—to start with, they represent a hope. We always knew we might some day have to fall back on our only real contact. That's why the Primey protective laws are so rigid; why the Primey

reservation compounds surrounding Alien settlements are guarded by our military detachments. The lynch spirit has been evolving into the pogrom spirit as human resentment and discomfort have been growing. Humanity First is beginning to feel strong enough to challenge United Mankind. And honestly, Hebster, at this point neither of us know which would survive a real fight. But you're one of the few who have talked to Primeys, worked with them—"

"Just on business."

"Frankly, that much of a start is a thousand times further along than the best that we've been able to manage. It's so blasted ironical that the only people who've had any conversation at all with the Primeys aren't even slightly interested in the imminent collapse of civilization! Oh, well. The point is that in the present political picture, you sink with us. Recognizing this, my people are prepared to forget a great deal and document you back into respectability. How about it?"

"Funny," Hebster said thoughtfully. "It can't be knowledge that makes miracle-workers out of fairly sober scientists. They all start shooting lightnings at their families and water out of rocks far too early in Primacy to have had time to learn new techniques. It's as if by merely coming close enough to the Aliens to grovel, they immediately move into position to tap a series of cosmic laws more basic than cause and effect."

The SIC man's face slowly deepened into purple. "Well, are you coming in, or aren't you? Remember Hebster, in these times, a man who insists on business as usual is a traitor to history."

"I think Kleimbocher *is* the end," Hebster nodded to himself. "Not much point in chasing Alien mentality if you're going to lose your best men on the way. I say let's forget all this nonsense of trying to live as equals in the same universe with Aliens. Let's concentrate on human problems and be grateful that they don't come into our major population centers and tell us to shove over."

The telephone rang. Braganza had dropped back into his swivel chair. He let the instrument squeeze out several piercing sonic bubbles while he clicked his strong square teeth and maintained a carefully-focused glare at his visitor. Finally, he picked it up, and gave it the verbal minima:

"Speaking. He is here. I'll tell him. 'Bye."

He brought his lips together, kept them pursed for a moment and then, abruptly, swung around to face the window.

"Your office, Hebster. Seems your wife and son are in town and have to see you on business. She the one you divorced ten years ago?"

Hebster nodded at his back and rose once more. "Probably wants her semi-

annual alimony dividend bonus. I'll have to go. Sonia never does office morale any good."

This meant trouble, he knew. "Wife-and-son" was executive code for something seriously wrong with Hebster Securities, Inc. He had not seen his wife since she had been satisfactorily maneuvered into giving him control of his son's education. As far as he was concerned, she had earned a substantial income for life by providing him with a well-mothered heir.

"Listen!" Braganza said sharply as Hebster reached the door. He still kept his eyes studiously on the street. "I tell you this: You don't want to come in with us. All right! You're a businessman first and a world citizen second. All right! But keep your nose clean, Hebster. If we catch you the slightest bit off base from now on, you'll get hit with everything. We'll not only pull the most spectacular trial this corrupt old planet has ever seen, but somewhere along the line, we'll throw you and your entire

organization to the wolves. We'll see to it that *Humanity First* pulls the Hebster Tower down around your ears."

Hebster shook his head, licked his lips. "*Why?* What would that accomplish?"

"Hah! It would give a lot of us here the craziest kind of pleasure. But it would also relieve us temporarily of some of the mass pressure we've been feeling. There's always the chance that Dempsey would lose control of his hotter heads, that they'd go on a real gory rampage, make with the sound and the fury sufficiently to justify full deployment of troops. We could knock off Dempsey and all of the big-shot Firsters then, because John Q. United Mankind would have seen to his own vivid satisfaction and injury what a dangerous mob they are."

"This," Hebster commented bitterly, "is the idealistic, legalistic world government!"

Braganza's chair spun around to face Hebster and his fist came down on the desk top with all the crushing finality of a magisterial gavel. "No, it is not! It is the SIC, a plenipotentiary and highly practical bureau of the UM, especially created to organize a relationship between Alien and human. Furthermore, it's the SIC in a state of the greatest emergency when the reign of law and world government may topple at a demagogue's belch. Do you think"—his head snaked forward belligerently, his eyes slitted to thin lines of purest contempt—"that the career and fortune, even the life, let us say, of as openly selfish a slug as you, Hebster, would be placed above that of the representative body of two billion *socially* operating human beings?"

The SIC official thumped his sloppily buttoned chest. "Braganza, I tell myself now, you're lucky he's too hungry for his blasted profit to take you up on that offer. Think how much fun it's going to be to sink a hook into him when he makes a mistake at last! To drop him onto the back of *Humanity First* so that they'll run amuck and destroy themselves! Oh, I get out, Hebster. I'm through with you."

He had made a mistake, Hebster reflected as he walked out of the armory and snapped his fingers at a gyrocab. The SIC was the most powerful single government agency in a Primey-infested world; offending them for a man in his position was equivalent to a cab driver delving into the more uncertain aspects of a traffic cop's ancestry in the policeman's pop-eyed presence.

But what could he do? Working with the SIC would mean working under Braganza—and since maturity, Algernon Hebster had been quietly careful to take orders from no man. It would mean giving up a business which, with a little more work and a little more time, might somehow still become the dominant combine on the planet. And worst of all, it would mean acquiring a social orientation to replace the calculating businessman's viewpoint which was the closest thing to a soul he had ever known.

The doorman of his building preceded him at a rapid pace down the side corridor that led to his private elevator and flourished aside for him to enter. The car stopped on the twenty-third floor. With a heart that had sunk so deep as to have practically foundered, Hebster picked his way along the wide-eyed clerical stares that lined the corridor. At the entrance to General Laboratory 23B, two tall men in the gray livery of his personal bodyguard moved apart to let him enter. If they had been recalled after having been told to take the day off, it meant that a full-dress emergency was being observed. He hoped that it had been declared in time to prevent any publicity leakage.

It had, Greta Seidenheim assured him. "I was down here applying the clamps five minutes after the fuss began. Floors twenty-one through twenty-five are closed off and all outside lines are being monitored. You can keep your employees an hour at most past five o'clock—which gives you a maximum of two hours and fourteen minutes."

He followed her green-tipped fingernail to the far corner of the lab where a body lay wrapped in murky rags. Theseus. Protruding from his back was the yellowed ivory handle of quite an old German S. S. dagger, 1942 edition. The silver swastika on the hilt had been replaced by an ornate symbol—an HF. Blood had soaked Theseus' long matted hair into an ugly red rug.

A dead Primey, Hebster thought, staring down hopelessly. In *his* building, in the laboratory to which the Primey had been spirited two or three jumps ahead of Yost and Funatti. This was capital offense material—if the courts ever got a chance to weigh it.

"Look at the dirty Primey-lover!" a slightly familiar voice jeered on his right. "He's scared! Make money out of *that*, Hebster!"

The corporation president strolled over to the thin man with the knobby, completely shaven head who was tied to an unused steampipe. The man's tie, which hung outside his laboratory smock, sported an unusual ornament about halfway down. It took Hebster several seconds to identify it. A miniature gold safety razor upon a black "3."

"He's a third echelon official of *Humanity First!*"

"He's also Charlie Verus of Hebster Laboratories," an extremely short man with a corrugated forehead told him. "My name is Margritt, Mr. Hebster, Dr. J. H. Margritt. I spoke to you on the communicator when the Primeys arrived."

Hebster shook his head determinedly. He waved back the other scientists who were milling around him self-consciously. "How long have third echelon officials, let alone ordinary members of *Humanity First*, been receiving salary checks in my laboratories?"

"I don't know." Margritt shrugged up at him. "Theoretically, no Firsters can be Hebster employees. Personnel is supposed to be twice as efficient as the SIC when it comes to sifting background. They probably are. But what can they do when an employee joins *Humanity First after* he's passed his probationary period? These proselyting times you'd need a complete force of secret police to keep tabs on all the new converts!"

"When I spoke to you earlier in the day, Margritt, you indicated disapproval of Verus. Don't you think it was your duty to let me know I had a Firster official about to mix it up with Primeys?"

The little man beat a violent negative back and forth with his chin. "I'm paid to supervise research, Mr. Hebster, not to co-ordinate your labor relations nor vote your political ticket!"

Contempt—the contempt of the creative researcher for the businessman-entrepreneur who paid his salary and was now in serious trouble—flickered behind every word he spoke. Why, Hebster wondered irritably, did people so despise a man who made money? Even the Primeys back in his office, Yost and Funatti, Braganza, Margritt—who had worked in his laboratories for years. It was his only talent. Surely, as such, it was as valid as a pianist's?

"I've never liked Charlie Verus," the lab chief went on, "but we never had reason to suspect him of Firstism! He must have hit the third echelon rank about a week ago, eh, Bert?"

"Yeah," Bert agreed from across the room. "The day he came in an hour late, broke every Florence flask in the place and told us all dreamily that one day we might be very proud to tell our grandchildren that we'd worked in the same lab with Charles Bolop Verus."

"Personally," Margritt commented, "I thought he might have just finished writing a book which proved that the Great Pyramid was nothing more than a prophecy in stone of our modern textile designs. Verus was that kind. But it probably was his little safety razor that tossed him up so high. I'd say he got the promotion as a sort of payment in advance for the job he finally did today."

Hebster ground his teeth at the carefully hairless captive who tried, unsuccessfully, to spit in his face; he hurried back to the door where his private secretary was talking to the bodyguard who had been on duty in the lab.

Beyond them, against the wall, stood Larry and S. S. Lusitania conversing in a low-voiced and anxious gabble-honk. They were evidently profoundly disturbed. S. S. Lusitania kept plucking tiny little elephants out of her rags which, kicking and trumpeting timidly, burst like malformed bubbles as she dropped them on the floor. Larry scratched his tangled beard nervously as he talked, periodically waving a hand at the ceiling which was already studded with fifty or sixty replicas of the dagger buried in Theseus. Hebster couldn't help thinking anxiously of what could have happened to his building if the Primeys had been able to act human enough to defend themselves.

"Listen, Mr. Hebster," the bodyguard began, "I was told not to—"

"Save it," Hebster rapped out. "This wasn't your fault. Even Personnel isn't to blame. Me and my experts deserve to have our necks chopped for falling so far behind the times. We can analyze any trend but the one which will make us superfluous. Greta! I want my roof helicopter ready to fly and my personal stratojet at LaGuardia alerted. Move, girl! And *you* . . . Williams is it?" he queried, leaning forward to read the bodyguard's name on his badge, "Williams, pack these two Primeys into my helicopter upstairs and stand by for a fast take-off."

He turned. "Everyone else!" he called. "You will be allowed to go home at six. You will be paid one hour's overtime. Thank you."

Charlie Verus started to sing as Hebster left the lab. By the time he reached the elevator, several of the clerks in the hallway had defiantly picked up the hymn. Hebster paused outside the elevator as he realized that fully one-fourth of the clerical personnel, male and female, were following Verus' cracked and mournful but terribly earnest tenor.

Mine eyes have seen the coming of
the glory of the shorn:
We will overturn the cess-pool
where the Primey slime is born,
We'll be wearing cleanly garments
as we face a human morn—
The First are on the march!
Glory, glory, hallelujah,
Glory, glory, hallelujah . . .

If it was like this in Hebster Securities, he thought wryly as he came into his private office, how fast was *Humanity First* growing among the broad masses of people? Of course, many of those singing could be put down as sympathizers rather than converts, people who were suckers for choral groups and vigilante posses—but how much more momentum did an organization have to generate to acquire the name of political juggernaut?

The only encouraging aspect was the SIC's evident awareness of the danger and the unprecedented steps they were prepared to take as countermeasure.

Unfortunately, the unprecedented

steps would take place upon Hebster.

He now had a little less than two hours, he reflected, to squirm out of the most serious single crime on the books of present World Law.

He lifted one of his telephones. "Ruth," he said. "I want to speak to Vandermeer Dempsey. Get me through to him personally."

She did. A few moments later he heard the famous voice, as rich and slow and thick as molten gold. "Hello Hebster, Vandermeer Dempsey speaking." He paused as if to draw breath, then went on sonorously: "*Humanity—may it always be ahead, but, ahead or behind, Humanity!*" He chuckled. "Our newest. What we call our telephone toast. Like it?"

"Very much," Hebster told him respectfully, remembering that this former video quizmaster might shortly be church and state combined. "Er . . . Mr. Dempsey, I notice you have a new book out, and I was wondering—"

"Which one? 'Anthropolitics'?"

"That's it. A fine study! You have some very quotable lines in the chapter headed, 'Neither More Nor Less Human.'"

A raucous laugh that still managed to bubble heavily. "Young man, I have quotable lines in every chapter of every book! I maintain a writer's assembly line here at headquarters that is capable of producing up to fifty-five memorable epigrams on any subject upon ten minutes' notice. Not to mention their capacity for political metaphors and two-line jokes with sexy implications! But you wouldn't be calling me to discuss literature, however good a job of emotional engineering I have done in my little text. What is it about, Hebster? Go into your pitch."

"Well," the executive began, vaguely comforted by the Firster chieftain's cynical approach and slightly annoyed at the openness of his contempt, "I had a chat today with your friend and my friend, P. Braganza."

"I know."

"You do? How?"

Vandermeer Dempsey laughed again, the slow, good-natured chortle of a fat man squeezing the curves out of a rocking chair. "Spies, Hebster, *spies*. I have them everywhere practically. This kind of politics is twenty per cent espionage, twenty per cent organization and sixty per cent waiting for the right moment. My spies tell me everything you do."

"They didn't by any chance tell you what Braganza and I discussed?"

"Oh, they did, young man, they did!" Dempsey chuckled a carefree scale exercise. Hebster remembered his pictures: the head like a soft and enormous orange, gouged by a brilliant smile. There was no hair anywhere on the head—all of it, down to the last eyelash and follicled wart, was removed regularly through electrolysis. "According to my agents, Braganza made several strong representations on behalf of the Special Investigating Commission which you rightly spurned. Then, somewhat out of sorts, he announced that if you were henceforth detected in the nefarious enterprises which every one knows have made you one of the wealthiest men on the face of the Earth, he would use you as bait for our anger. I must say I admire the whole ingenious scheme immensely."

"And you're not going to bite," Hebster suggested. Greta Seidenheim entered the office and made a circular gesture at the ceiling. He nodded.

"On the contrary, Hebster, we *are* going to bite. We're going to bite with just a shade more vehemence than we're expected to. We're going to swallow this provocation that the SIC is devising for us and go on to make a world-wide revolution out of it. We *will*, my boy."

Hebster rubbed his left hand back and forth across his lips. "Over my dead body!" He tried to chuckle himself and managed only to clear his throat. "You're right about the conversation with Braganza, and you may be right about how you'll do when it gets down to paving stones and baseball bats. But, if you'd like to have the whole thing a lot easier, there is a little deal I have in mind—"

"Sorry, Hebster my boy. No deals. Not on this. Don't you see we really *don't* want to have it easier? For the same reason, we pay our spies nothing despite the risks they run and the great growing wealth of *Humanity First*. We found that the spies we acquired through conviction worked harder and took many more chances than those forced into our arms by economic pressure. No, we desperately need *L'affaire Hebster* to inflame the populace. We need enough excitement running loose so that it transmits to the gendarmerie and the soldiery, so that conservative citizens who normally shake their heads at a parade will drop their bundles and join the rape and robbery. Enough such citizens and Terra goes *Humanity First*."

"Heads you win, tails I lose."

The liquid gold of Dempsey's laughter poured. "I see what you mean, Hebster. Either way, UM or HF, you wind up a smear-mark on the sands of time. You had your chance when we asked for contributions from public-spirited businessmen four years ago. Quite a few of your competitors were able to see the valid relationship between economics and politics. Woodran of the Underwood Investment Trust is a first echelon official today. Not a single one of *your* top executives wears a razor. But, even so, whatever happens to you will be mild compared to the Primeys."

"The Aliens may object to their body-servants being mauled."

"There are no Aliens!" Dempsey replied in a completely altered voice. He sounded as if he had stiffened too

much to be able to move his lips.

"No Aliens? Is that your latest line? You don't mean that!"

"There are only Primeys—creatures who have resigned from human responsibility and are therefore able to do many seemingly miraculous things, which real humanity refuses to do because of the lack of dignity involved. But there are no Aliens. Aliens are a Primey myth."

Hebster grunted. "That is the ideal way of facing an unpleasant fact. Stare right through it."

"If you insist on talking about such illusions as Aliens," the rustling and angry voice cut in, "I'm afraid we can't continue the conversation. You're evidently going Prime, Hebster."

The line went dead.

Hebster scraped a finger inside the mouthpiece rim. "He believes his own stuff!" he said in an awed voice. "For all of the decadent urbanity, he has to have the same reassurance he gives his followers—the horrible, superior thing just isn't there!"

Greta Seidenheim was waiting at the door with his briefcase and both their coats. As he came away from the desk, he said, "I won't tell you not to come along, Greta, but—"

"Good," she said, swinging along behind him. "Think we'll make it to —wherever we're going?"

"Arizona. The first and largest Alien settlement. The place our friends with the funny names come from."

"What can you do there that you can't do here?"

"Frankly, Greta, I don't know. But it's a good idea to lose myself for a while. Then again, I want to get in the area where all this agony originates and take a close look. I'm an off-the-cuff businessman; I've done all of my important figuring on the spot."

There was bad news waiting for them outside the helicopter. "Mr. Hebster," the pilot told him tonelessly while cracking a dry stick of gum, "the stratojet's been seized by the SIC. Are we still going? If we do it in this thing, it won't be very far or very fast."

"We're still going," Hebster said after a moment's hesitation.

They climbed in. The two Primeys sat on the floor in the rear, sneezing conversationally at each other. Williams waved respectfully at his boss. "Gentle as lambs," he said. "In fact, they made one. I had to throw it out."

The large pot-bellied craft climbed up its rope of air and started forward from the Hebster Building.

"There must have been a leak," Greta muttered angrily. "They heard about the dead Primey. Somewhere in the organization there's a leak that I haven't been able to find. The SIC heard about the dead Primey and now they're hunting us down. Real efficient, I am!"

Hebster smiled at her grimly. She *was* very efficient. So was Personnel and a dozen other subdivisions of the organization. So was Hebster himself. But these were functioning members of a normal business designed for stable times. *Political* spies! If Dempsey could have spies and saboteurs all over Hebster Securities, why couldn't Braganza? They'd catch him before he had even started running; they'd bring him back before he could find a loophole.

They'd bring him back for trial, perhaps, for what in all probability would be known to history as the Bloody Hebster Incident. The incident that had precipitated a world revolution.

"Mr. Hebster, they're getting restless," Williams called out. "Should I relax 'em out, kind off?"

Hebster sat up sharply, hopefully. "No," he said. "Leave them alone!" He watched the suddenly agitated Primeys very closely. This was the odd chance for which he'd brought them along! Years of haggling with Primeys had taught him a lot about them. They were good for other things than sheer gimmick-craft.

Two specks appeared on the windows. They enlarged sleekly into jets with SIC insignia.

"Pilot!" Hebster called, his eyes on Larry who was pulling painfully at his beard. "Get away from the controls! Fast! Did you hear me? That was an *order! Get away from those controls!*"

The man moved off reluctantly. He was barely in time. The control board dissolved into rattling purple shards behind him. The vanes of the gyro seemed to flower into indigo saxophones. Their ears rang with supersonic frequencies as they rose above the jets on a spout of unimaginable force.

Five seconds later they were in Arizona.

They piled out of their weird craft into a sage-cluttered desert.

"I don't ever want to know what my windmill was turned into," the pilot commented, "or what was used to push it along—but how did the Primey come to understand the cops were after us?"

"I don't think he knew that," Hebster explained, "but he was sensitive enough to know he was going home, and that somehow those jets were there to prevent it. And so he functioned, in terms of his interests, in what was almost a human fashion. He protected himself!"

"Going home," Larry said. He'd been listening very closely to Hebster, dribbling from the right-hand corner of his mouth as he listened. "Haemostat, hammersdarts, hump. Home is where the hate is. Hit is where the hump is. Home and locks the door."

S.S. Lusitania had started on one leg and favored them with her peculiar fleshy smile. "Hindsight," she suggested archly, "is no more than home site. Gabble, honk?"

Larry started after her, some three feet off the ground. He walked the air

slowly and painfully as if the road he traveled were covered with numerous small boulders all of them pitilessly sharp.

"Good-by, people," Hebster said. "I'm off to see the wizard with my friends in greasy gray here. Remember, when the SIC catches up to your unusual vessel—stay close to it for that purpose, by the way—it might be wise to refer to me as someone who forced you into this. You can tell them I've gone into the wilderness looking for a solution, figuring that if I went Prime I'd still be better off than as a punching bag whose ownership is being hotly disputed by such characters as P. Braganza and Vandermeer Dempsey. I'll be back with my mind or on it."

He patted Greta's cheek on the wet spot; then he walked deftly away in pursuit of S.S. Lusitania and Larry. He glanced back once and smiled as he saw them looking curiously forlorn, especially Williams, the chunky young man who earned his living by guarding other people's bodies.

The Primeys followed a route of sorts, but it seemed to have been designed by someone bemused by the motions of an accordion. Again and again it doubled back upon itself, folded across itself, went back a hundred yards and started all over again.

This was Primey country—Arizona, where the first and largest Alien settlement had been made. There were mighty few humans in this corner of the southwest any more—just the Aliens and their coolies.

"Larry," Hebster called as an uncomfortable thought struck him. "Larry! Do . . . do your masters know I'm coming?"

Missing his step as he looked up at Hebster's peremptory question, the Primey tripped and plunged to the ground. He rose, grimaced at Hebster and shook his head. "You are not a businessman," he said. "Here there can be no business. Here there can only be humorous what-you-might-call-worship. The movement to the universal, the inner nature—The realization, complete and eternal, of the partial and evanescent that alone enables . . . that alone enables—" His clawed fingers writhed into each other, as if he were desperately trying to pull a communicable meaning out of the palms. He shook his head with a slow rolling motion from side to side.

Hebster saw with a shock that the old man was crying. Then going Prime had yet another similarity to madness! It gave the human an understanding of something thoroughly beyond himself, a mental summit he was constitutionally incapable of mounting. It gave him a glimpse of some psychological promised land, then buried him, still yearning, in his own inadequacies. And it left him at last bereft of pride in his realizable accomplishments with a kind of myopic half-knowledge of where he wanted to go but with no means of getting there.

"When I first came," Larry was saying haltingly, his eyes squinting into Hebster's face, as if he knew what the businessman was thinking, "when first I tried to know . . . I mean the charts and textbooks I carried here, my statistics, my plotted curves were so useless. All playthings I found, disorganized, based on shadow-thought. And then, Hebster, to watch real-thought, real-control! You'll see the joy—You'll serve beside us, you will! Oh, the enormous lifting—"

His voice died into angry incoherencies as he bit into his fist. S.S. Lusitania came up, still hopping on one foot. "Larry," she suggested in a very soft voice, "gabble-honk Hebster away?"

He looked surprised, then nodded. The two Primeys linked arms and clambered laboriously back up to the invisible road from which Larry had fallen. They stood facing him for a moment, looking like a weird, ragged, surrealistic version of Tweedledee and Tweedledum.

Then they disappeared and darkness fell around Hebster as if it had been knocked out of the jar. He felt under himself cautiously and sat down on the sand which retained all the heat of daytime Arizona.

Now!

Suppose an Alien came. Suppose an Alien asked him point-blank what it was that he wanted. That would be bad. Algernon Hebster, businessman extraordinary—slightly on the run, at the moment, of course—didn't know what he wanted; not with reference to Aliens.

He didn't want them to leave, because the Primey technology he had used in over a dozen industries was essentially an interpretation and adaptation of Alien methods. He didn't want them to stay because whatever was orderly in his world was dissolving under the acids of their omnipresent superiority.

He also knew that he personally did not want to go Prime.

What was left then? Business? Well, there was Braganza's question. What does a businessman do when demand is so well controlled that it can be said to have ceased to exist?

Or what does he do in a case like the present, when demand might be said to be nonexistent, since there was nothing the Aliens seemed to want of Man's puny hoard?

"He *finds* something they want," Hebster said out loud.

How? *How?* Well, the Indian still sold his decorative blankets to the paleface as a way of life, as a source of income. And he insisted on being paid in cash—not firewater. If *only*, Hebster thought, he could somehow contrive to meet an Alien—he'd find out soon enough what its needs were, what was basically desired.

And then as the retort-shaped, the tube-shaped, the bell-shaped bottles materialized all around him, he un-

derstood! They had been forming the insistent questions in his mind. And they weren't satisfied with the answers he had found thus far. They liked answers. They liked answers very much indeed. If he was interested, there was always a way—

A great dots-in-bottle brushed his cortex and he screamed. "No! I don't *want* to!" he explained desperately.

Ping! went the dots-in-bottle and Hebster grabbed at his body. His continuing flesh reassured him. He felt

very much like the girl in Greek mythology who had begged Zeus for the privilege of seeing him in the full regalia of his godhood. A few moments after her request had been granted, there had been nothing left of the inquisitive female but a fine feathery ash.

The bottles were swirling in and out of each other in a strange and intricate dance from which there radiated emotions vaguely akin to curiosity, yet partaking of amusement and rapture.

Why rapture? Hebster was positive he had caught that note, even allowing for the lack of similarity between mental patterns. He ran a hurried dragnet through his memory, caught a few corresponding items and dropped them after a brief, intensive examination. What was he trying to remember —what was his supremely efficient businessman's instincts trying to remind him of?

The dance became more complex, more rapid. A few bottles had passed under his feet and Hebster could see them, undulating and spinning some ten feet below the surface of the ground as if their presence had made the Earth a transparent as well as permeable medium. Completely unfamiliar with all matters Alien as he was, not knowing—nor caring!—whether they danced as an expression of the counsel they were taking together, or as a matter of necessary social ritual, Hebster was able none the less to sense an approaching climax. Little crooked lines of green lightning began to erupt between the huge bottles. Something exploded near his left ear. He rubbed his face fearfully and moved away. The bottles followed, maintaining him in the imprisoning sphere of their frenzied movements.

Why *rapture?* Back in the city, the Aliens had had a terribly studious air about them as they hovered, almost motionless, above the works and lives of mankind. They were cold and careful scientists and showed not the slightest capacity for . . . for—

So he had something. At last he had something. But what do you do with an idea when you can't communicate it and can't act upon it yourself?

Ping!

The previous invitation was being repeated, more urgently. *Ping! Ping! Ping!*

"No!" he yelled and tried to stand. He found he couldn't. "I'm not . . . I don't want to go Prime!"

There was detached, almost divine laughter.

He felt that awful scrabbling inside his brain as if two or three entities were jostling each other within it. He shut his eyes hard and thought. He was close, he was very close. He had an idea, but he needed time to formulate it—a little while to figure out just exactly what the idea was and just exactly what to do with it!

Ping, ping, ping! Ping, ping, ping!

He had a headache. He felt as if his mind were being sucked out of his head. He tried to hold on to it. He couldn't.

All right, then. He relaxed abruptly, stopped trying to protect himself. But with his mind and his mouth, he yelled. For the first time in his life and with only a partially formed conception of whom he was addressing the desperate call to, Algernon Hebster screamed for help.

"I can do it!" he alternately screamed and thought. "Save money, save time, save whatever it is you want to save, whoever you are and whatever you call yourself—I can help you save! Help me, *help me*—*We* can do it—but *hurry*. Your problem can be solved—Economize. The balance-sheet—*Help*—"

The words and frantic thoughts spun in and out of each other like the contracting rings of Aliens all around him. He kept screaming, kept the focus on his mental images, while, unbearably, somewhere inside him, a gay and jocular force began to close a valve on his sanity.

Suddenly, he had absolutely no sensation. Suddenly, he knew dozens of things he had never dreamed he could know and had forgotten a thousand times as many. Suddenly, he felt that every nerve in his body was under control of his forefinger. Suddenly, he—

Ping, ping, ping! Ping! Ping! PING! PING! PING! PING!

". . . Like that," someone said.

"What, for example?" someone else asked.

"Well, they don't even lie normally. He's been sleeping like a human being. They twist and moan in their sleep, the Primeys do, for all the world like habitual old drunks. Speaking of moans, here comes our boy."

Hebster sat up on the army cot, rattling his head. The fears were leaving him, and, with the fears gone, he would no longer be hurt. Braganza, highly concerned and unhappy, was standing next to his bed with a man who was obviously a doctor. Hebster smiled at both of them, manfully resisting the temptation to drool out a string of nonsense syllables.

"Hi, fellas," he said. "Here I come, ungathering nuts in May."

"You don't mean to tell me you communicated!" Braganza yelled. "You communicated and didn't go Prime!"

Hebster raised himself on an elbow and glanced out past the tent flap to where Greta Seidenheim stood on the other side of a port-armed guard. He waved his fist at her, and she nodded a wide-open smile back.

"Found me lying in the desert like a waif, did you?"

"*Found* you!" Braganza spat. "You were brought in by Primeys, man. First time in history they ever did that. We've been waiting for you to come to in the serene faith that once you did, everything would be all right."

The corporation president rubbed his forehead. "It will be, Braganza, it will be. Just Primeys, eh? No Aliens helping them?"

"*Aliens?*" Braganza swallowed. "What led you to believe—What gave you reason to hope that . . . that *Aliens* would help the Primeys bring you in?"

"Well, perhaps I shouldn't have used the word 'help.' But I did think there would be a few Aliens in the group that escorted my unconscious body back to you. Sort of an honor guard, Braganza. It would have been a real nice gesture, don't you think?"

The SIC man looked at the doctor who had been following the conversation with interest. "Mind stepping out for a minute?" he suggested.

He walked behind the man and dropped the tent flap into place. Then he came around to the foot of the army cot and pulled on his mustache vigorously. "Now, see here, Hebster, if you keep up this clowning, so help me I will slit your belly open and snap your intestines back in your face! *What happened?*"

"What happened?" Hebster laughed and stretched slowly, carefully, as if he were afraid of breaking the bones of his arm. "I don't think I'll ever be able to answer that question completely. And there's a section of my mind that's very glad that I won't. This much I remember clearly: I had an idea. I communicated it to the proper and interested party. We concluded—this party and I—a tentative agreement as agents, the exact terms of the agreement to be decided by our principals and its complete ratification to be contingent upon their acceptance. Furthermore, we—All right, Braganza, all right! I'll tell it straight. Put down that folding chair. Remember, I've just been through a pretty unsettling experience!"

"Not any worse than the world is about to go through," the official growled. "While you've been out on your three-day vacation, Dempsey's been organizing a full-dress revolution every place at once. He's been very careful to limit it to parades and verbal fireworks so that we haven't been able to make with the riot squads, but it's pretty evident that he's ready to start using muscle. Tomorrow might be it; he's spouting on a world-wide video hookup and it's the opinion of the best experts we have available that his tag line will be the signal for action. Know what their slogan is? It concerns Verus who's been indicted for murder; they claim he'll be a martyr."

"And you were caught with your suspicions down. How many SIC men turned out to be Firsters?"

Braganza nodded. "Not too many, but more than we expected. More than we could afford. He'll do it, Dempsey will, unless you've hit the real thing. Look, Hebster," his heavy voice took on a pleading quality, "don't play with me any more. Don't hold my

threats against me; there was no personal animosity in them, just a terrible, fearful worry over the world and its people and the government I was supposed to protect. If you still have a gripe against me, I, Braganza, give you leave to take it out of my hide as soon as we clear this mess up. But let me know where we stand first. A lot of lives and a lot of history depend on what you did out there in that patch of desert."

Hebster told him. He began with the extraterrestrial *Walpurgis Nacht*. "Watching the Aliens slipping in and out of each other in that cock-eyed and complicated rhythm, it struck me how different they were from the thoughtful dots-in-bottles hovering over our busy places, how different all creatures are in their home environments—and how hard it is to get to know them on the basis of their company manners. And then I realized that this place wasn't their home."

"Of course. Did you find out which part of the galaxy they come from?"

"That's not what I mean. Simply because we have marked this area off—and others like it in the Gobi, in the Sahara, in Central Australia—as a reservation for those of our kind whose minds have crumbled under the clear, conscious and certain knowledge of inferiority, we cannot assume that the Aliens around whose settlements they have congregated have necessarily settled themselves."

"*Huh?*" Braganza shook his head rapidly and batted his eyes.

"In other words we had made an assumption on the basis of the Aliens' very evident superiority to ourselves. But that assumption—and therefore that superiority—was in our own terms of what is superior and inferior, and not the Aliens'. And it especially might not apply to those Aliens on . . . the reservation."

The SIC man took a rapid walk around the tent. He beat a great fist into an open sweaty palm. "I'm beginning to, just beginning to—"

"That's what I was doing at that point, just beginning to. Assumptions that don't stand up under the structure they're supposed to support have caused the ruin of more close-thinking businessmen than I would like to face across any conference table. The four brokers, for example, who, after the market crash of 1929—"

"All right," Braganza broke in hurriedly, taking a chair near the cot. "Where did you go from there?"

"I still couldn't be certain of anything; all I had to go on were a few random thoughts inspired by extrasubstantial adrenalin secretions and, of course, the strong feeling that these particular Aliens weren't acting the way I had become accustomed to expect Aliens to act. They reminded me of something, of somebody. I was positive that once I got that memory tagged, I'd have most of the problem solved. And I was right."

"How were you right? What was the memory?"

"Well, I hit it backwards, kind of. I went back to Professor Kleimbocher's analogy about the paleface inflicting firewater on the Indian. I've always felt that somewhere in that analogy was the solution. And suddenly, thinking of Professor Kleimbocher and watching those powerful creatures writhing their way in and around each other, suddenly I knew what was wrong. Not the analogy, but our way of using it. We'd picked it up by the hammer head instead of the handle. The paleface gave firewater to the Indian all right—but he got something in return."

"What?"

"Tobacco. Now there's nothing very much wrong with tobacco if it isn't misused, but the first white men to smoke probably went as far overboard as the first Indians to drink. And both booze and tobacco have this in common—they make you awfully sick if you use too much for your initial experiment. See, Braganza? These Aliens out here in the desert reservation are *sick*. They have hit something in our culture that is as psychologically indigestible to them as . . . well, whatever they have that sticks in our mental gullet and causes ulcers among us. They've been put into a kind of isolation in our desert areas until the problem can be licked."

"Something that's as indigestible psychologically—What could it be, Hebster?"

The businessman shrugged irritably. "I don't know. And I don't want to know. Perhaps it's just that they can't let go of a problem until they've solved it—and they can't solve the problems of mankind's activity because of mankind's inherent and basic differences. Simply because we can't understand them, we had no right to assume that they could and did understand us."

"That wasn't all, Hebster. As the comedians put it—everything we can do, they can do better."

"Then why did they keep sending Primeys in to ask for those weird gadgets and impossible gimcracks?"

"They could duplicate anything we made."

"Well, maybe that is it," Hebster suggested. "They could duplicate it, but could they design it? They show every sign of being a race of creatures who never had to make very much for themselves; perhaps they evolved fairly early into animals with direct control over matter, thus never having had to go through the various stages of artifact design. This, in our terms, is a tremendous advantage; but it inevitably would have concurrent disadvantages. Among other things, it would mean a minimum of art forms and a lack of basic engineering knowledge of the artifact itself if not of the directly activated and altered material. The fact is I was right, as I found out later.

For example. Music is not a function

of theoretical harmonics, of complete scores in the head of a conductor or composer—these come later, much later. Music is first and foremost a function of the particular instrument, the reed pipe, the skin drum, the human throat—it is a function of tangibles which a race operating upon electrons, positrons and mesons would never encounter in the course of its construction. As soon as I had that, I had the other flaw in the analogy—the assumption itself."

"You mean the assumption that we are necessarily inferior to the Aliens?"

"Right, Braganza. They can do a lot that we can't do, but vice very much indeed versa. How many special racial talents we possess that they don't is a matter of pure conjecture—and may continue to be for a good long time. Let the theoretical boys worry that one a century from now, just so they stay away from it at present."

Braganza fingered a button on his green jerkin and stared over Hebster's head. "No more scientific investigation of them, eh?"

"Well, we can't right now and we have to face up that mildly unpleasant situation. The consolation is that they have to do the same. Don't you see? It's not a basic inadequacy. We don't have enough facts and can't get enough at the moment through normal channels of scientific observation because of the implicit psychological dangers to both races. Science, my forward-looking friend, is a complex of interlocking theories, *all derived from observation*.

"Remember, long before you had any science of navigation you had coast-hugging and river-hopping traders who knew how the various currents affected their leaky little vessels, who had learned things about the relative dependability of the moon and the stars—without any interest at all in integrating these scraps of knowledge into broader theories. Not until you have a sufficiently large body of these scraps, and are able to distinguish the preconceptions from the the actual observations, can you proceed to organize a science of navigation without running the grave risk of drowning while you conduct your definitive experiments.

"A trader isn't interested in theories. He's interested only in selling something that glitters for something that glitters even more. In the process, painlessly and imperceptibly, he picks up bits of knowledge which gradually reduce the area of unfamiliarity. Until one day there are enough bits of knowledge on which to base a sort of preliminary understanding, a working hypothesis. And then, some Kleimbocher of the future, operating in an area no longer subject to the sudden and unexplainable mental disaster, can construct meticulous and exact laws out of the more obviously valid hypotheses."

"I might have known it would be something like this, if you came back with it, Hebster! So their theorists and our theorists had better move out and the traders move in. Only how do we contact their traders—if they have any such animals?"

The corporation president sprang out of bed and began dressing. "They have them. Not a Board of Director type perhaps—but a business-minded Alien. As soon as I realized that the dots-in-bottles were acting, relative to their balanced scientific colleagues, very like our own high IQ Primeys, I knew I needed help. I needed someone I could tell about it, someone on their side who had as great a stake in an operating solution as I did. There had to be an Alien in the picture somewhere who was concerned with profit and loss statements, with how much of a return you get out of a given investment of time, personnel, materiel and energy. I figured with him I could talk—*business*. The simple approach: What have you got that we want and how little of what we have will you take for it. No attempts to understand completely incompatible philosophies. There had to be that kind of character somewhere in the expedition. So I shut my eyes and let out what I fondly hoped was a telepathic *yip* channeled to him. I was successful.

"Of course, I might not have been successful if he hadn't been searching desperately for just that sort of *yip*. He came buzzing up in a rousing United States Cavalry-routs-the-redskins type of rescue, stuffed my dripping psyche back into my subconscious and hauled me up into some sort of never-never-ship. I've been in this interstellar version of Mohammed's coffin, suspended between Heaven and Earth, for three days, while he alternately bargained with me and consulted the home office about developments.

"We dickered the way I do with Primeys—by running down a list of what each of us could offer and comparing it with what we wanted; each of us trying to get a little more than we gave to the other guy, in our own terms, of course. Buying and selling are intrinsically simple processes; I don't imagine our discussions were very much different from those between a couple of Phoenician sailors and the blue-painted Celtic inhabitants of early Britain."

"And this . . . this business-Alien never suggested the possibility of taking what they wanted—"

"By force? No, Braganza, not once. Might be they're too civilized for such shenanigans. Personally, I think the big reason is that they don't have any idea of what it is they do want from us. We represent a fantastic enigma to them—a species which uses matter to alter matter, producing objects which, while intended for similar functions, differ enormously from each other. You might say that we ask the question '*how?*' about their activities; and they want to know the '*why?*' about

ours. Their investigators have compulsions even greater than ours. As I understand it, the intelligent races they've encountered up to this point are all comprehensible to them since they derive from parallel evolutionary paths. Every time one of their researchers get close to the answer of why we wear various colored clothes even in climates where clothing is unnecessary, he slips over the edges and splashes.

"Of course, that's why this opposite number of mine was so worried. I don't know his exact status—he may be anything from the bookkeeper to the business-manager of the expedition—but it's his bottle-neck if the outfit continues to be uneconomic. And I gathered that not only has his occupation kind of barred him from doing the investigation his unstable pals were limping back from into the asylums he's constructed here in the deserts, but those of them who've managed to retain their sanity constantly exhibit a healthy contempt for him. They feel, you see, that their function is that of the expedition. He's strictly supercargo. Do you think it bothers them one bit," Hebster snorted, "that he has a report to prepare, to show how his expedition stood up in terms of a balance sheet—"

"Well, you did manage to communicate on that point, at least," Braganza grinned. "Maybe traders using the simple, earnestly chiseling approach will be the answer. You've certainly supplied us with more basic data already than years of heavily subsidized research. Hebster I want you to go on the air with this story you told me and show a couple of Primey Aliens to the video public."

"Uh-uh. You tell 'em. You can use the prestige. I'll think a message to my Alien buddy along the private channel he's keeping open for me, and he'll send you a couple of human-happy dots-in-bottles for the telecast. I've got to whip back to New York and get my entire outfit to work on a really encyclopedic job."

"Encyclopedic?"

The executive pulled his belt tight and reached for a tie. "Well, what else would you call the first edition of the Hebster Interstellar Catalogue of all Human Activity and Available Artifacts, prices available upon request with the understanding that they are subject to change without notice?"

THE END

BRIDGE

BY JAMES BLISH

***The Bridge** was built from nowhere, across hell itself, to nowhere, under conditions no living thing could endure, at immense cost —and the building of it, not the Bridge, was the important thing!*

Illustrated by Orban

I.

A screeching tornado was rocking the Bridge when the alarm sounded; it was making the whole structure shudder and sway. This was normal, and Robert Helmuth barely noticed it. There was always a tornado shaking the Bridge. The whole planet was enswathed in tornadoes, and worse.

The scanner on the foreman's board had given 114 as the sector of the trouble. That was at the northwestern end of the Bridge, where it broke off, leaving nothing but the raging clouds of ammonia crystals and methane, and a sheer drop thirty miles to the invisible surface. There were no ultraphone "eyes" at that end which gave a general view of the area—in so far as any general view was possible—because both ends of the Bridge were incomplete.

With a sigh Helmuth put the beetle into motion. The little car, as flat-bottomed and thin through as a bedbug, got slowly under way on its ball-bearing races, guided and held firmly to the surface of the Bridge by ten

close-set flanged rails. Even so, the hydrogen gales made a terrific siren-like shrieking between the edge of the vehicle and the deck, and the impact of the falling drops of ammonia upon the curved roof was as heavy and deafening as a rain of cannon balls. As a matter of fact, they weighed almost as much as cannon balls here, though they were not much bigger than ordinary raindrops. Every so often, too, there was a blast, accompanied by a dull orange glare, which made the car, the deck, and the Bridge itself buck savagely.

These blasts were below, however, on the surface. While they shook the structure of the Bridge heavily, they almost never interfered with its functioning, and could not, in the very nature of things, do Helmuth any harm.

Had any real damage ever been done, it would never have been repaired. There was no one on Jupiter to repair it.

The Bridge, actually, was building itself. Massive, alone, and lifeless, it grew in the black deeps of Jupiter.

The Bridge had been well-planned. From Helmuth's point of view almost nothing could be seen of it, for the beetle tracks ran down the center of the deck, and in the darkness and perpetual storm even ultrawave-assisted vision could not penetrate more than a few hundred yards at the most. The width of the Bridge was eleven miles; its height, thirty miles; its length, deliberately unspecified in the plans, fifty-four miles at the moment—a squat, colossal structure, built with engineering principles, methods, materials and tools never touched before—

For the very good reason that they would have been impossible anywhere else. Most of the Bridge, for instance, was made of ice: a marvelous structural material under a pressure of a million atmospheres, at a temperature of −94°C. Under such conditions, the best structural steel is a friable, talclike powder, and aluminum becomes a peculiar, transparent substance that splits at a tap.

Back home, Helmuth remembered, there had been talk of starting another Bridge on Saturn, and perhaps, still later, on Uranus, too. But that had been politicians' talk. The Bridge was almost five thousand miles below the visible surface of Jupiter's atmosphere, and its mechanisms were just barely manageable. The bottom of Saturn's atmosphere had been sounded at sixteen thousand eight hundred seventy-eight miles, and the temperature there was below −150°C. There even pressure-ice would be immovable, and could not be worked with anything except itself. And as for Uranus . . .

As far as Helmuth was concerned, Jupiter was quite bad enough.

The beetle crept within sight of the end of the Bridge and stopped automatically. Helmuth set the vehicle's eyes for highest penetration, and examined the nearby beams.

The great bars were as close-set as screening. They had to be, in order to support even their own weight, let alone the weight of the components of the Bridge. The whole web-work was flexing and fluctuating to the harpist-fingered gale, but it had been designed to do that. Helmuth could never help being alarmed by the movement, but habit assured him that he had nothing to fear from it.

He took the automatics out of the circuit and inched the beetle forward manually. This was only Sector 113, and the Bridge's own Wheatstone-bridge scanning system—there was no electronic device anywhere on the Bridge, since it was impossible to maintain a vacuum on Jupiter—said that the trouble was in Sector 114. The boundary of Sector 114 was still fully fifty feet away.

It was a bad sign. Helmuth scratched nervously in his red beard. Evidently there was really cause for alarm—real alarm, not just the deep, grinding depression which he always felt while working on the Bridge. Any damage serious enough to halt the beetle a full sector short of the trouble area was bound to be major.

It might even turn out to be the disaster which he had felt lurking ahead of him ever since he had been made foreman of the Bridge—that disaster which the Bridge itself could not repair, sending man reeling home from Jupiter in defeat.

The secondaries cut in and the beetle stopped again. Grimly, Helmuth opened the switch and sent the beetle creeping across the invisible danger line. Almost at once, the car tilted just perceptibly to the left, and the screaming of the winds between its edges and the deck shot up the scale, sirening in and out of the soundless-dogwhistle range with an eeriness that set Helmuth's teeth on edge. The beetle itself fluttered and chattered like an alarm-clock hammer between the surface of the desk and the flanges of the tracks.

Ahead there was still nothing to be seen but the horizontal driving of the clouds and the hail, roaring along the length of the Bridge, out of the blackness into the beetle's fanlights, and onward into blackness again toward the horizon no eye would ever see.

Thirty miles below, the fusillade of hydrogen explosions continued. Evidently something really wild was going on on the surface. Helmuth could not remember having heard so much activity in years.

There was a flat, especially heavy crash, and a long line of fuming orange fire came pouring down the seething atmosphere into the depths, feathering horizontally like the mane of a Lipizzan horse, directly in front of Helmuth. Instinctively, he winced and drew back from the board, although that stream of flame actually

was only a little less cold than the rest of the streaming gases, far too cold to injure the Bridge.

In the momentary glare, however, he saw something—an upward twisting of shadows, patterned but obviously unfinished, fluttering in silhouette against the hydrogen cataract's lurid light.

The end of the Bridge.

Wrecked.

Helmuth grunted involuntarily and backed the beetle away. The flare dimmed; the light poured down the sky and fell away into the raging sea below. The scanner clucked with satisfaction as the beetle recrossed the line into Zone 113.

He turned the body of the vehicle 180°, presenting its back to the dying torrent. There was nothing further that he could do at the moment on the Bridge. He scanned his control board—a ghost image of which was cast across the scene on the Bridge—for the blue button marked *Garage*, punched it savagely, and tore off his helmet.

Obediently, the Bridge vanished.

II.

Dillon was looking at him.

"Well?" the civil engineer said. "What's the matter, Bob? Is it bad—?"

Helmuth did not reply for a moment. The abrupt transition from the storm-ravaged deck of the Bridge to the quiet, placid air of the control shack on Jupiter V was always a shock. He had never been able to anticipate it, let alone become accustomed to it; it was worse each time, not better.

He put the helmet down carefully in front of him and got up, moving carefully upon shaky legs; feeling implicit in his own body the enormous pressures and weights his guiding intelligence had just quitted. The fact that the gravity on the foreman's deck was as weak as that of most of the habitable asteroids only made the contrast greater, and his need for caution in walking more extreme.

He went to the big porthole and looked out. The unworn, tumbled, monotonous surface of airless Jupiter V looked almost homey after the perpetual holocaust of Jupiter itself. But there was an overpowering reminder of that holocaust—for through the thick quartz the face of the giant planet stared at him, across only one hundred twelve thousand six hundred miles: a sphere-section occupying almost all of the sky except the near horizon. It was crawling with color, striped and blotched with the eternal, frigid, poisonous storming of its atmosphere, spotted with the deep planet-sized shadows of farther moons.

Somewhere down there, six thousand miles below the clouds that boiled in his face, was the Bridge. The Bridge was thirty miles high and eleven miles wide and fifty-four miles long—but it was only a sliver, an intricate and fragile arrangement of ice-crystals beneath the bulging, racing tornadoes.

On Earth, even in the West, the Bridge would have been the mightiest engineering achievement of all history, could the Earth have borne its weight at all. But on Jupiter, the Bridge was as precarious and perishable as a snowflake.

"Bob?" Dillon's voice asked. "You seem more upset than usual. Is it serious?" Helmuth turned. His superior's worn young face, lantern-jawed and crowned by black hair already beginning to gray at the temples, was alight both with love for the Bridge and the consuming ardor of the responsibility he had to bear. As always, it touched Helmuth, and reminded him that the implacable universe had, after all, provided one warm corner in which human beings might huddle together.

"Serious enough," he said, forming the words with difficulty against the frozen inarticulateness Jupiter forced upon him. "But not fatal, as far as I could see. There's a lot of hydrogen vulcanism on the surface, especially at the northwest end, and it looks like there must have been a big blast under the cliffs. I saw what looked like the last of a series of fireballs."

Dillon's face relaxed while Helmuth was talking, slowly, line by engraved line. "Oh. Just a flying chunk, then."

"I'm almost sure that's what it was. The cross-drafts are heavy now. The Spot and the STD are due to pass each other some time next week, aren't they? I haven't checked, but I can feel the difference in the storms."

"So the chunk got picked up and thrown through the end of the Bridge. A big piece?"

Helmuth shrugged. "That end is all twisted away to the left, and the deck is burst to flinders. The scaffolding is all gone, too, of course. A pretty big piece, all right, Charity—two miles through at a minimum."

Dillon sighed. He, too, went to the window, and looked out. Helmuth did not need to be a mind reader to know what he was looking at. Out there, across the stony waste of Jupiter V plus one hundred twelve thousand six hundred miles of space, the South Tropical Disturbance was streaming toward the great Red Spot, and would soon overtake it. When the whirling funnel of the STD—more than big enough to suck three Earths into deep-freeze—passed the planetary island of sodium-tainted ice which was the Red Spot, the Spot would follow it for a few thousand miles, at the same time rising closer to the surface of the atmosphere.

Then the Spot would sink again, drifting back toward the incredible jet of stress-fluid which kept it in being—a jet fed by no one knew what forces at Jupiter's hot, rocky, twenty-two thousand mile core, under sixteen thousand miles of eternal ice. During the entire passage, the storms all over

Jupiter became especially violent; and the Bridge had been forced to locate in anything but the calmest spot on the planet, thanks to the uneven distribution of the few permanent landmasses.

Helmuth watched Dillon with a certain compassion, tempered with mild envy. Charity Dillon's unfortunate given name betrayed him as the song of a hangover, the only male child of a Witness family which dated back to the great Witness Revival of 2003. He was one of the hundreds of government-drafted experts who had planned the Bridge, and he was as obsessed by the Bridge as Helmuth was—but for different reasons.

Helmuth moved back to the port, dropping his hand gently upon Dillon's shoulder. Together they looked at the screaming straw yellows, brick reds, pinks, oranges, browns, even blues and greens that Jupiter threw across the ruined stone of its innermost satellite. On Jupiter V, even the shadows had color.

Dillon did not move. He said at last: "Are you pleased, Bob?"

"Pleased?" Helmuth said in astonishment. "No. It scares me white; you know that. I'm just glad that the whole Bridge didn't go."

"You're quite sure?" Dillon said quietly.

Helmuth took his hand from Dillon's shoulder and returned to his seat at the central desk. "You've no right to needle me for something I can't help," he said, his voice even lower than Dillon's. "I work on Jupiter four hours a day—not actually, because we can't keep a man alive for more than a split second down there—but my eyes and my ears and my mind are there, on the Bridge, four hours a day. Jupiter is not a nice place. I don't like it. I won't pretend I do.

"Spending four hours a day in an environment like that over a period of years—well, the human mind instinctively tries to adapt, even to the unthinkable. Sometimes I wonder how I'll behave when I'm put back in Chicago again. Sometimes I can't remember anything about Chicago except vague generalities, sometimes I can't even believe there is such a place as Earth—how could there be, when the rest of the universe is like Jupiter, or worse?"

"I know," Dillon said. "I've tried several times to show you that isn't a very reasonable frame of mind."

"I know it isn't. But I can't help how I feel. No, I don't think the Bridge will last. It can't last; it's all wrong. But I don't *want* to see it go. I've just got sense enough to know that one of these days Jupiter is going to sweep it away."

He wiped an open palm across the control boards, snapping all the toggles "Off" with a sound like the fall of a double-handful of marbles on a pane of glass. "Like that, Charity! And I work four hours a day, every day, on the Bridge. One of these days, Jupiter is going to destroy the Bridge. It'll go flying away in little flinders, into the storms. My mind will be there, supervising some puny job, and my mind will go flying away along with my mechanical eyes and ears—still trying to adapt to the unthinkable, tumbling away into the winds and the flames and the rains and the darkness and the pressure and the cold."

"Bob, you're deliberately running away with yourself. Cut it out. Cut it out, I say!"

Helmuth shrugged, putting a trembling hand on the edge of the board to steady himself. "All right. I'm all right, Charity. I'm here, aren't I? Right here on Jupiter V, in no danger, in no danger at all. The Bridge is one hundred twelve thousand six hundred miles away from here. But when the day comes that the Bridge is swept away—

"Charity, sometimes I imagine you ferrying my body back to the cozy nook it came from, while my soul goes tumbling and tumbling through millions of cubic miles of poison. All

right, Charity, I'll be good. I won't think about it out loud; but you can't expect me to forget it. It's on my mind; I can't help it, and you should know that."

"I do," Dillon said, with a kind of eagerness. "I do, Bob. I'm only trying to help, to make you see the problem as it is. The Bridge isn't really that awful, it isn't worth a single nightmare."

"Oh, it isn't the Bridge that makes me yell out when I'm sleeping," Helmuth said, smiling bitterly. "I'm not that ridden by it yet. It's while I'm awake that I'm afraid the Bridge will be swept away. What I sleep with is a fear of myself."

"That's a sane fear. You're as sane as any of us," Dillon insisted, fiercely solemn. "Look, Bob. The Bridge isn't a monster. It's a way we've developed for studying the behavior of materials under specific conditions of temperature, pressure, and gravity. Jupiter isn't Hell, either; it's a set of conditions. The Bridge is the laboratory we set up to work with those conditions."

"It isn't going anywhere. It's a bridge to no place."

"There aren't many *places* on Jupiter," Dillon said, missing Helmuth's meaning entirely. "We put the Bridge on an island in the local sea because we needed solid ice we could sink the caissons in. Otherwise, it wouldn't have mattered where we put it. We could have floated it on the sea itself, if we hadn't wanted to fix it in order to measure storm velocities and such things."

"I know that," Helmuth said.

"But Bob, you don't show any signs of understanding it. Why, for instance, should the Bridge *go* any place? It isn't even, properly speaking, a bridge at all. We only call it that because we used some bridge engineering principles in building it. Actually, it's much more like a traveling crane—an extremely heavy-duty overhead rail line. It isn't going anywhere because it hasn't any place interesting to go, that's all. We're extending it to cover as much territory as possible, and to increase its stability, not to span the distance between places. There's no point to reproaching it because it doesn't span a real gap—between, say, Dover and Calais. It's a bridge to knowledge, and that's far more important. Why can't you see that?"

"I can see that; that's what I was talking about," Helmuth said, trying to control his impatience. "I have as much common sense as the average child. What I was trying to point out is that meeting colossalness with colossalness—out here—is a mug's game. It's a game Jupiter will always win, without the slightest effort. What if the engineers who built the Dover-Calais bridge had been limited to broomstraws for their structural members? They could have got the bridge up somehow, sure, and made it strong enough to carry light traffic on a fair day. But what would you have had left of it after the first winter storm came down the Channel from the North Sea? The whole approach is idiotic!"

"All right," Dillon said reasonably. "You have a point. Now you're being reasonable. What better approach have you to suggest? Should we abandon Jupiter entirely because it's too big for us?"

"No," Helmuth said. "Or maybe, yes. I don't know. I don't have any easy answer. I just know that this one is no answer at all—it's just a cumbersome evasion."

Dillon smiled. "You're depressed, and no wonder. Sleep it off, Bob, if you can—you might even come up with that answer. In the meantime—well, when you stop to think about it, the surface of Jupiter isn't any more hostile, inherently, than the surface of Jupiter V, except in degree. If you stepped out of this building naked, you'd die just as fast as you would on Jupiter. Try to look at it that way."

Helmuth, looking forward into another night of dreams, said: "That's the way I look at it now."

III.

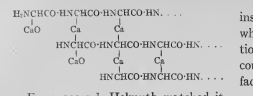
There were three yellow "Critical" signals lit on the long gang board when Helmuth passed through the gang deck on the way back to duty. All of them, as usual, were concentrated on Panel 9, where Eva Chavez worked.

Eva, despite her Latin name—such once-valid tickets no longer meant anything among Earth's uniformly mixed-race population—was a big girl, vaguely blond, who cherished a passion for the Bridge. Unfortunately, she was apt to become enthralled by the sheer Cosmicness of it all, precisely at the moments when cold analysis and split-second decisions were most crucial.

Helmuth reached over her shoulder, cut her out of the circuit except as an observer, and donned the co-operator's helmet. The incomplete new shoals caisson sprang into being around him. Breakers of boiling hydrogen seethed seven hundred feet up along its slanted sides—breakers that never subsided, but simply were torn away into flying spray.

There was a spot of dull orange near the top of the north face of the caisson, crawling slowly toward the pediment of the nearest truss. Catalysis—

Or cancer, as Helmuth could not help but think of it. On this bitter, violent monster of a planet, even the tiny specks of calcium carbide were deadly. At these wind velocities, such specks imbedded themselves in everything; and at fifteen million pounds per square inch, pressure ice catalyzed by sodium took up ammonia and carbon dioxide, building proteinlike compounds in a rapid, deadly chain of decay:



For a second, Helmuth watched it grow. It was, after all, one of the incredible possibilities the Bridge had been built to study. On Earth, such a compound, had it occurred at all, might have grown porous, bony, and quite strong. Here, under nearly eight times the gravity, the molecules were forced to assemble in strict aliphatic order, but in cross section their arrangement was hexagonal, as if the stuff would become an aromatic compound if it only could. Even here it was moderately strong in cross section—but along the long axis it smeared like graphite, the calcium atoms readily surrendering their valence hold on one carbon atom to grab hopefully for the next one in line—

No stuff to hold up the piers of humanity's greatest engineering project. Perhaps it was suitable for the ribs of some Jovian jellyfish, but in a Bridge-caisson, it was cancer.

There was a scraper mechanism working on the edge of the lesion, flaking away the shearing aminos and laying down new ice. In the meantime, the decay of the caisson-face was working deeper. The scraper could not possibly get at the core of the trouble—which was not the calcium carbide dust, with which the atmosphere was charged beyond redemption, but was instead one imbedded sodium speck which was taking no part in the reaction—fast enough to extirpate it. It could barely keep pace with the surface spread of the disease.

And laying new ice over the surface of the wound was worthless. At this rate, the whole caisson would slough away and melt like butter, within an hour, under the weight of the Bridge above it.

Helmuth sent the futile scraper aloft. Drill for it? No—too deep already, and location unknown.

Quickly he called two borers up from the shoals below, where constant blasting was taking the foundation of the caisson deeper and deeper into Jupiter's dubious "soil." He drove both blind, fire-snouted machines down into the lesion.

The bottom of that sore turned out to be forty-five meters within the immense block. Helmuth pushed the red button all the same.

The borers blew up, with a heavy, quite invisible blast, as they had been designed to do. A pit appeared on the face of the caisson.

The nearest truss bent upward in the wind. It fluttered for a moment, trying to resist. It bent farther.

Deprived of its major attachment, it tore free suddenly, and went whirling away into the blackness. A sudden flash of lightning picked it out for a moment, and Helmuth saw it dwindling like a bat with torn wings being borne away by a cyclone.

The scraper scuttled down into the pit and began to fill it with ice from the bottom. Helmuth ordered down a new truss and a squad of scaffolders. Damage of this order took time to repair. He watched the tornado tearing ragged chunks from the edges of the pit until he was sure that the catalysis had stopped. Then, suddenly, prematurely, dismally tired, he took off the helmet.

He was astounded by the white fury that masked Eva's big-boned, mildly pretty face.

"You'll blow the Bridge up yet, won't you?" she said, evenly, without preamble. "Any pretext will do!"

Baffled, Helmuth turned his head helplessly away, but that was no better. The suffused face of Jupiter peered swollenly through the picture-port, just as it did on the foreman's desk.

He and Eva and Charity and the gang and the whole of satellite V were falling forward toward Jupiter; their uneventful, cooped-up lives on Jupiter V were utterly unreal compared to the four hours of each changeless day spent on Jupiter's ever-changing surface. Every new day brought their minds, like ships out of control, closer and closer to that gaudy inferno.

There was no other way for a man—or a woman—on Jupiter V to look at the giant planet. It was simple experience, shared by all of them, that planets do not occupy four-fifths of the whole sky, unless the observer is himself up there in that planet's sky, falling, falling faster and faster—

"I have no intention," he said tiredly, "of blowing up the Bridge. I wish you could get it through your head that I want the Bridge to stay up—even though I'm not starry-eyed to the point of incompetence about the project. Did you think that rotten spot was going to go away by itself when you'd painted it over? Didn't you know that—"

Several helmeted, masked heads nearby turned blindly toward the sound of his voice. Helmuth shut up. Any distracting conversation or activity was taboo, down here in the gang room. He motioned Eva back to duty.

The girl donned her helmet obediently enough, but it was plain from the way her normally full lips were thinned that she thought Helmuth had ended the argument only in order to have the last word.

Helmuth strode to the thick pillar which ran down the central axis of the shack, and mounted the spiraling cleats toward his own foreman's cubicle. Already he felt in anticipation the weight of the helmet upon his own head.

Charity Dillon, however, was already wearing the helmet; he was sitting in Helmuth's chair.

Charity was characteristically oblivious of Helmuth's entrance. The

Bridge operator must learn to ignore, to be utterly unconscious of anything happening around his body except the inhuman sounds of signals; must learn to heed only those senses which report something going on thousands of miles away.

Helmuth knew better than to interrupt him. Instead, he watched Dillon's white, bladelike fingers roving with blind sureness over the controls.

Dillon, evidently, was making a complete tour of the Bridge—not only from end to end, but up and down, too. The tally board showed that he had already activated nearly two-thirds of the ultraphone eyes. That meant that he had been up all night at the job; had begun it immediately after last talking to Helmuth.

Why?

With a thrill of unfocused apprehension, Helmuth looked at the foreman's jack, which allowed the operator here in the cubicle to communicate with the gang when necessary, and which kept him aware of anything said or done at gang boards.

It was plugged in.

Dillon sighed suddenly, took the helmet off, and turned.

"Hello, Bob," he said. "Funny about this job. You can't see, you can't hear, but when somebody's watching you, you feel a sort of pressure on the back of your neck. ESP, maybe. Ever felt it?"

"Pretty often, lately. Why the grand tour, Charity?"

"There's to be an inspection," Dillon said. His eyes met Helmuth's. They were frank and transparent. "A mob of Western officials, coming to see that their eight billion dollars isn't being wasted. Naturally, I'm a little anxious to see that they find everything in order."

"I see," Helmuth said. "First time in five years, isn't it?"

"Just about. What was that dust-up down below just now? Somebody—you, I'm sure, from the drastic handiwork involved—bailed Eva out of a mess, and then I heard her talk about your wanting to blow up the Bridge. I checked the area when I heard the fracas start, and it did seem as if she had let things go rather far, but—What was it all about?"

Dillon ordinarily hadn't the guile for cat-and-mouse games, and he had never looked less guileful now. Helmuth said carefully, "Eva was upset, I suppose. On the subject of Jupiter we're all of us cracked by now, in our different ways. The way she was dealing with the catalysis didn't look to me to be suitable—a difference of opinion, resolved in my favor because I had the authority, Eva didn't. That's all."

"Kind of an expensive difference, Bob. I'm not niggling by nature, you know that. But an incident like that while the commission is here—"

"The point is," Helmuth said, "are we to spend an extra ten thousand, or whatever it costs to replace a truss and reinforce a caisson, or are we to lose the whole caisson—and as much as a third of the whole Bridge along with it?"

"Yes, you're right there, of course. That could be explained, even to a pack of senators. But—it would be difficult to have to explain it very often. Well, the board's yours, Bob: You could continue my spot-check, if you've time."

Dillon got up. Then he added suddenly, as if it were forced out of him:

"Bob, I'm trying to understand your state of mind. From what Eva said, I gather that you've made it fairly public. I . . . I don't think it's a good idea to infect your fellow workers with your own pessimism. It leads to sloppy work. I know that regardless of your own feelings you won't countenance sloppy work, but one foreman can do only so much. And you're making extra work for yourself—not for me, but for yourself—by being openly gloomy about the Bridge.

"You're the best man on the Bridge, Bob, for all your grousing about the job, and your assorted misgivings. I'd hate to see you replaced."

"A threat, Charity?" Helmuth said softly.

"*No.* I wouldn't replace you unless you actually went nuts, and I firmly believe that your fears in that respect are groundless. It's a commonplace that only sane men suspect their own sanity, isn't it?"

"It's a common misconception. Most psychopathic obsessions begin with a mild worry."

Dillon made as if to brush that subject away. "Anyhow, I'm not threatening; I'd fight to keep you here. But my say-so only covers Jupiter V; there are people higher up on Ganymede, and people higher yet back in Washington—and in this inspecting commission.

"Why don't you try to look on the bright side for a change? Obviously the Bridge isn't ever going to inspire you. But you might at least try thinking about all those dollars piling up in your account every hour you're on this job, and about the bridges and ships and who knows what-all that you'll be building, at any fee you ask, when you get back down to Earth. All under the magic words, 'One of the men who built the Bridge on Jupiter!' "

Charity was bright red with embarrassment and enthusiasm. Helmuth smiled.

"I'll try to bear it in mind, Charity," he said. "When is this gaggle of senators due to arrive?"

"They're on Ganymede now, taking a breather. They came directly from Washington without any routing. I suppose they'll make a stop at Callisto before they come here. They've something new on their ship, I'm told, that lets them flit about more freely than the usual uphill transport can."

An icy lizard suddenly was nesting in Helmuth's stomach, coiling and coiling but never settling itself. The room blurred. The persistent nightmare was suddenly almost upon him—already.

"Something . . . new?" he echoed, his voice as flat and noncommittal as he could make it. "Do you know what it is?"

"Well, yes. But I think I'd better keep quiet about it until—"

"Charity, nobody on this deserted rock-heap could possibly be a Soviet spy. The whole habit of 'security' is idiotic out here. Tell me now and save me the trouble of dealing with senators; or tell me at least that you know I know. *They have antigravity!* Isn't that it?"

One word from Dillon, and the nightmare would be real.

"Yes," Dillon said. "How did you know? Of course, it couldn't be a complete gravity screen by any means. But it seems to be a good long step toward it. We've waited a long time to see that dream come true— But you're the last man in the world to take pride in the achievement, so there's no sense exulting about it to you. I'll let you know when I get a definite arrival date. In the meantime, will you think about what I said before?"

"Yes, I will." Helmuth took the seat before the board.

"Good. With you, I have to be grateful for small victories. Good trick, Bob."

"Good trick, Charity."

IV.

Instead of sleeping—for now he knew that he was really afraid—he sat up in the reading chair in his cabin. The illuminated microfilmed pages of a book flipped by across the surface of the wall opposite him, timed precisely to the reading rate most comfortable for him, and he had several weeks' worry-conserved alcohol and smoke rations for ready consumption.

But Helmuth let his mix go flat, and did not notice the book, which had turned itself on, at the page where he had abandoned it last, when he had fitted himself into the chair. Instead, he listened to the radio.

There was always a great deal of ham radio activity in the Jovian system. The conditions were good for it, since there was plenty of power available, few impeding atmosphere layers and those thin, no Heaviside layers, and few official and no commercial channels with which the hams could interfere.

And there were plenty of people scattered about the satellites who needed the sound of a voice.

" . . . anybody know whether the senators are coming here? Doc Barth put in a report a while back on a fossil plant he found here, at least he thinks it was a plant. Maybe they'd like a look at it."

"They're supposed to hit the Bridge team next." A strong voice, and the impression of a strong transmitter wavering in and out; that would be Sweeney, on Ganymede. "Sorry to throw the wet blanket, boys, but I don't think the senators are interested in our rock-balls for their own lumpy selves. We could only hold them here three days."

Helmuth thought grayly: *Then they've already left Callisto.*

"Is that you, Sweeney? Where's the Bridge tonight?"

"Dillon's on duty," a very distant transmitter said. "Try to raise Helmuth, Sweeney."

"Helmuth, Helmuth, you gloomy beetle-gooser! Come in, Helmuth!"

"Sure, Bob, come in and dampen us."

Sluggishly, Helmuth reached out to take the mike, where it lay clipped to one arm of the chair. But the door to his room opened before he had completed the gesture.

Eva came in.

She said, "Bob, I want to tell you something."

"His voice is changing!" the voice of the Callisto operator said. "Ask him what he's drinking, Sweeney!"

Helmuth cut the radio out. The girl was freshly dressed—in so far as anybody dressed in anything on Jupiter V—and Helmuth wondered why

she was prowling the decks at this hour, halfway between her sleep period and her trick. Her hair was hazy against the light from the corridor, and she looked less mannish than usual. She reminded him a little of the way she had looked when they first met.

"All right," he said. "I owe you a mix, I guess. Citric, sugar and the other stuff is in the locker . . . you know where it is. Shot-cans are there, too."

The girl shut the door and sat down on the bunk, with a free litheness that was almost grace, but with a determination which Helmuth knew meant that she had just decided to do something silly for all the right reasons.

"I don't need a drink," she said. "As a matter of fact, lately I've been turning my lux-R's back to the common pool. I suppose you did that for me—by showing me what a mind looked like that is hiding from itself."

"Eve, stop sounding like a tract. Obviously you've advanced to a higher, more Jovian plane of existence, but won't you still need your metabolism? Or have you decided that vitamins are all-in-the-mind?"

"Now you're being superior. Anyhow, alcohol isn't a vitamin. And I didn't come to talk about that. I came to tell you something I think you ought to know."

"Which is?"

She said, "Bob, I mean to have a child here."

A bark of laughter, part sheer hysteria and part exasperation, jackknifed Helmuth into a sitting position. A red arrow bloomed on the far wall, obediently marking the paragraph which, supposedly, he had reached in his reading, and the page vanished.

"*Women!*" he said, when he could get his breath back. "Really, Evita, you make me feel much better. No environment can change a human being much, after all."

"Why should it?" she said suspiciously. "I don't see the joke. Shouldn't a woman want to have a child?"

"Of course she should," he said, settling back. The flipping pages began again. "It's quite ordinary. All women want to have children. All women dream of the day they can turn a child out to play in an airless rock-garden, to pluck fossils and get quaintly star-burned. How cozy to tuck the little blue body back into its corner that night, promptly at the sound of the trick-change bell! Why, it's as natural as Jupiter-light—as Earthian as vacuum-frozen apple pie."

He turned his head casually away. "As for me, though, Eva, I'd much prefer that you take your ghostly little pretext out of here."

Eva surged to her feet in one furious motion. Her fingers grasped him by the beard and jerked his head painfully around again.

"You reedy male platitude!" she said, in a low grinding voice. "How you could see almost the whole point and make so little of it—*Women*, is it? So you think I came creeping in here, full of humbleness, to settle our technical differences."

He closed his hand on her wrist and twisted it away. "What else?" he demanded, trying to imagine how it would feel to stay reasonable for five minutes at a time with these Bridge-robots. "None of us need bother with games and excuses. We're here, we're isolated, we were all chosen because, among other things, we were judged incapable of forming permanent emotional attachments, and capable of such alliances as we found attractive without going unbalanced when the attraction diminished and the alliance came unstuck. None of us have to pretend that our living arrangements would keep us out of jail in Boston, or that they have to involve any Earth-normal excuses."

She said nothing. After a while he asked, gently, "Isn't that so?"

"Of course it's so. Also it has nothing to do with the matter."

"It doesn't? How stupid do you think I am? *I* don't care whether or not you've decided to have a child here, if you really mean what yousay."

She was trembling with rage. "You really don't, too. The decision means nothing to you."

"Well, if I liked children, I'd be sorry for the child. But as it happens, I can't stand children. In short, Eva, as far as I'm concerned you can have as many as you want, and to me you'll *still* be the worst operator on the Bridge."

"I'll bear that in mind," she said. At this moment she seemed to have been cut from pressure-ice. "I'll leave you something to charge your mind with, too, Robert Helmuth. I'll leave you sprawled here under your precious book . . . what is Madame Bovary to you, anyhow, you unadventurous turtle? . . . to think about a man who believes that children must always be born into warm cradles—a man who thinks that men have to huddle on warm worlds, or they won't survive. A man with no ears, no eyes, scarcely any head. A man in terror, a man crying Mamma! *Mamma!* all the stellar days and nights long!"

"Parlor diagnosis!"

"Parlor labeling! Good trick, Bob. Draw your warm woolly blanket in tight about your brains, or some little sneeze of sense might creep in, and impair your—efficiency!"

The door closed sharply after her.

A million pounds of fatigue crashed down without warning on Helmuth's brain, and he fell back into the reading chair with a gasp. The roots of his beard ached, and Jupiters bloomed and wavered away before his closed eyes.

He struggled once, and fell asleep.

Instantly he was in the grip of the dream.

It started, as always, with commonplaces, almost realistic enough to be a documentary film-strip—except for the appalling sense of pressure, and the distorted emotional significance with which the least word, the smallest movement was invested.

It was the sinking of the first caisson of the Bridge. The actual event had been bad enough. The job demanded enough exactness of placement to require that manned ships enter Jupiter's atmosphere itself: a squadron of twenty of the most powerful ships ever built, with the five million ton asteroid, trimmed and shaped in space, slung beneath them in an immense cat's cradle.

Four times that squadron had disappeared beneath the clouds; four times the tense voices of pilots and engineers had muttered in Helmuth's ears; four times there were shouts and futile orders and the snapping of cables and someone screaming endlessly against the eternal howl of the Jovian sky.

It had cost, altogether, nine ships and two hundred and thirty-one men, to get one of five laboriously shaped asteroids planted in the shifting slush that was Jupiter's surface. Helmuth had helped to supervise all five operations, counting the successful one, from his desk on Jupiter V; but in the dream he was not in the control shack, but instead on shipboard, in one of the ships that was never to come back—

Then, without transition, but without any sense of discontinuity either, he was on the Bridge itself. Not *in absentia*, as the remote guiding intelligence of a beetle, but in person, in an ovular, tanklike suit the details of which would never come clear. The high brass had discovered antigravity, and had asked for volunteers to man the Bridge. Helmuth had volunteered.

Looking back on it in the dream, he did not understand why he had volunteered. It had simply seemed expected of him, and he had not been able to help it, even though he had known what it would be like. He belonged on the Bridge, though he hated it—he had been doomed to go there, from the first.

And there was . . . something wrong . . . with the antigravity. The high brass had asked for its volunteers before the scientific work had been completed. The present antigravity fields were weak, and there was some basic flaw in the theory. Generators broke down after only short periods of use, burned out, unpredictably, sometimes only moments after testing up without a flaw—like vacuum tubes in waking life.

That was what Helmuth's set was about to do. He crouched inside his personal womb, above the boiling sea, the clouds raging about him, lit by a plume of hydrogen flame, and waited to feel his weight suddenly become eight times greater than normal. He knew what would happen to him then.

It happened.

Helmuth greeted morning on Jupiter V with his customary scream.

V.

The ship that landed as he was going on duty did nothing to lighten the load on his heart. In shape it was not distinguishable from any of the long-range cruisers which ran the legs of the Moon-Mars-Belt-Ganymede trip. But it grounded its huge bulk with less visible expenditures of power than one of the little intersatellary boats.

That landing told Helmuth that his dream was well on its way to coming true. If the high brass had had a real antigravity, there would have been no reason why the main jets should have been necessary at all. Obviously, what had been discovered was some sort of partial screen, which allowed a ship to operate with far less jet action than was normal, but which still left it subject to a sizable fraction of the universal stress of space.

Nothing less than a complete and completely controllable antigravity would do on Jupiter.

He worked mechanically, noting that Charity was not in evidence. Probably he was conferring with the senators, receiving what would be for him the glad news.

Helmuth realized suddenly that there was nothing left for him to do now but to cut and run.

There could certainly be no reason why he should have to re-enact the entire dream, helplessly, event for event, like an actor committed to a play. He was awake now, in full control of his own senses, and still at least partially sane. The man in the dream had volunteered—but that man would not be Robert Helmuth. Not any longer.

While the senators were here, he would turn in his resignation. Direct, over Charity's head.

"Wake up, Helmuth," a voice from the gang deck snapped suddenly. "If it hadn't been for me, you'd have run yourself off the end of the Bridge. You had all the automatic stops on that beetle cut out."

Helmuth reached guiltily and more than a little too late for the controls. Eva had already run his beetle back beyond the danger line.

"Sorry," he mumbled. "Thanks, Eva."

"Don't thank me. If you'd actually been in it, I'd have let it go. Less reading and more sleep is what I recommend for you, Helmuth."

"Keep your recommendations to yourself," he snapped.

The incident started a new and even more disturbing chain of thought. If he were to resign now, it would be nearly a year before he could get back to Chicago. Antigravity or no antigravity, the senators' ship would have no room for unexpected extra passengers. Shipping a man back home had to be arranged far in advance. Space had

to be provided, and a cargo equivalent of the weight and space requirements he would take up on the return trip had to be deadheaded out to Jupiter.

A year of living in the station on Jupiter V without any function—as a man whose drain on the station's supplies no longer could be justified in terms of what he did. A year of living under the eyes of Eva Chavez and Charity Dillon and the other men and women who still remained Bridge operators, men and women who would not hesitate to let him know what they thought of his quitting.

A year of living as a bystander in the feverish excitement of direct, personal exploration of Jupiter. A year of watching and hearing the inevitable deaths—while he alone stood aloof, privileged and useless. A year during which Robert Helmuth would become the most hated living entity in the Jovian system.

And, when he got back to Chicago and went looking for a job—for his resignation from the Bridge gang would automatically take him out of government service—he would be asked why he left the Bridge at the moment when work on the Bridge was just reaching its culmination.

He began to understand why the man in the dream had volunteered.

When the trick-change bell rang, he was still determined to resign, but he had already concluded bitterly that there were, after all, other kinds of hells besides the one on Jupiter.

He was returning the board to neutral as Charity came up the cleats. Charity's eyes were snapping like a skyful of comets. Helmuth had known that they would be.

"Senator Wagoner wants to speak to you, if you're not too tired, Bob," he said. "Go ahead; I'll finish up there."

"He does?" Helmuth frowned. The dream surged back upon him. *No.* They would not rush him any faster than he wanted to go. "What about, Charity? Am I suspected of unWestern activities? I suppose you've told them how I feel."

"I have," Dillon said, unruffled. "But we're agreed that you may not feel the same way after you've talked to Wagoner. He's in the ship, of course. I've put out a suit for you at the lock."

Charity put the helmet over his head, effectively cutting himself off from further conversation, or from any further consciousness of Helmuth at all.

Helmuth stood looking at him a moment. Then, with a convulsive shrug, he went down the cleats.

Three minutes later, he was plodding in a spacesuit across the surface of Jupiter V, with the vivid bulk of Jupiter splashing his shoulders with color.

A courteous Marine let him through the ship's air lock and deftly peeled him out of the suit. Despite a grim determination to be uninterested in the new antigravity and any possible consequence of it, he looked curiously about as he was conducted up toward the bow.

But the ship was like the ones that had brought him from Chicago to Jupiter V—it was like any spaceship: there was nothing in it to see but corridor walls and stairwells, until you arrived at the cabin where you were needed.

Senator Wagoner was a surprise. He was a young man, no more than sixty-five at most, not at all portly, and he had the keenest pair of blue eyes that Helmuth had ever seen. He received Helmuth alone, in his own cabin—a comfortable cabin as spaceship accommodations go, but neither roomy nor luxurious. He was hard to match up with the stories Helmuth had been hearing about the current Senate, which had been involved in scandal after scandal of more than Roman proportions.

Helmuth looked around. "I thought there were several of you," he said.

"There are, but I didn't want to give you the idea that you were facing a panel," Wagoner said, smiling. "I've been forced to sit in on most of these endless loyalty investigations back home, but I can't see any point in exporting such religious ceremonies to deep space. Do sit down, Mr. Helmuth. There are drinks coming. We have a lot to talk about."

Stiffly, Helmuth sat down.

"Dillon tells me," Wagoner said, leaning back comfortably in his own chair, "that your usefulness to the Bridge is about at an end. In a way, I'm sorry to hear that, for you've been one of the best men we've had on any of our planetary projects. But, in another way, I'm glad. It makes you available for something much bigger, where we need you much more."

"What do you mean by that?"

"I'll explain in a moment. First, I'd like to talk a little about the Bridge. Please don't feel that I'm quizzing you, by the way. You're at perfect liberty to say that any given question is none of my business, and I'll take no offense and hold no grudge. Also, 'I hereby disavow the authenticity of any tape or other tapping of which this statement may be a part.' In short, our conversation is unofficial, highly so."

"Thank you."

"It's to my interest; I'm hoping that you'll talk freely to me. Of course my disavowal means nothing, since such formal statements can always be excised from a tape; but later on I'm going to tell you some things you're not supposed to know, and you'll be able to judge by what I say then that anything you say to me is privileged. O.K.?"

A steward came in silently with the drinks, and left again. Helmuth tasted his. As far as he could tell, it was exactly like many he had mixed for himself back in the control shack, from standard space rations. The only difference was that it was cold, which Helmuth found startling, but not unpleasant after the first sip. He tried to relax. "I'll do my best," he said.

"Good enough. Now: Dillon says that you regard the Bridge as a monster. I've examined your dossier pretty closely, and I think perhaps Dillon hasn't quite the gist of your meaning. I'd like to hear it straight from you."

"I don't think the Bridge is a monster," Helmuth said slowly. "You see, Charity is on the defensive. He takes the Bridge to be conclusive evidence that no possible set of adverse conditions ever will stop man for long, and there I'm in agreement with him. But he also thinks of it as Progress, personified. He can't admit —you asked me to speak my mind, senator—that the West is a decadent and dying culture. All the other evidence that's available shows that it is. Charity likes to think of the Bridge as giving the lie to that evidence."

"The West hasn't many more years," Wagoner agreed, astonishingly. "Still and all, the West has been responsible for some really towering achievements in its time. Perhaps the Bridge could be considered as the last and the mightiest of them all."

"Not by me," Helmuth said. "The building of gigantic projects for ritual purposes—doing a thing for the sake of doing it—is the last act of an already dead culture. Look at the pyramids in Egypt for an example. Or an even more idiotic and more enormous example, bigger than anything human beings have accomplished yet, the laying out of the 'Diagram of Power' over the whole face of Mars. If the Martians had put all that energy into survival instead, they'd probably be alive yet."

"Agreed," Wagoner said.

"All right. Then maybe you'll also agree that the essence of a vital culture is its ability to defend itself. The West has beaten off the Soviets for a century now—but as far as I can see, the Bridge is the West's 'Diagram of Power,' its pyramids, or what have you. All the money and the resources that went into the Bridge are going to be badly needed, *and won't be there*, when the next Soviet attack comes."

"Which will be very shortly, I'm told," Wagoner said, with complete calm. "Furthermore, it will be successful, and in part it will be successful for the very reasons you've outlined. For a man who's been cut off from the Earth for years, Helmuth, you seem to know more about what's going on down there than most of the general populace does."

"Nothing promotes an interest in Earth like being off it," Helmuth said. "And there's plenty of time to read out here." Either the drink was stronger than he had expected, or the senator's calm concurrence in the collapse of Helmuth's entire world had given him another shove toward nothingness; his head was spinning.

Wagoner saw it. He leaned forward suddenly, catching Helmuth flat-footed. "*However*," he said, "it's difficult for me to agree that the Bridge serves, or ever did serve, a ritual purpose. The Bridge served a huge practical purpose which is now fulfilled—the Bridge, as such, is now a defunct project."

"Defunct?" Helmuth repeated faintly.

"Quite. Of course we'll continue to operate it for a while, simply because you can't stop a process of that size on a dime, and that's just as well for people like Dillon who are emotionally tied up in it. You're the one person with any authority in the whole station who has already lost enough interest in the Bridge to make it safe for me to tell you that it's being abandoned."

"But why?"

"Because," Wagoner went on quietly, "the Bridge has now given us confirmation of a theory of stupendous importance—so important, in my opinion, that the imminent fall of the West seems like a puny event in comparison. A confirmation, incidentally, which contains in it the seeds of ultimate destruction for the Soviets, whatever they may win for themselves in the next fifty years or so."

"I suppose," Helmuth said, puzzled, "that you mean antigravity?"

For the first time, it was Wagoner's turn to be taken aback. "Man," he said at last, "do you know *everything* I want to tell you? I hope not, or my conclusions will be mighty suspicious. Surely Charity didn't tell you we had antigravity; I strictly enjoined him not to mention it."

"No, the subject's been on my mind," Helmuth said. "But I certainly don't see why it should be so world-shaking, any more than I see how the Bridge helped to bring it about. I thought it had been developed independently, for the further exploitation of the Bridge, and would step up Bridge operation, not discontinue it."

"Not at all. Of course, the Bridge has given us information in thousands of different categories, much of it very valuable indeed. But the one job that *only* the Bridge could do was that of confirming, or throwing out, the Blackett-Dirac equations."

"Which are—?"

"A relationship between magnetism and the spinning of a massive body—that much is the Dirac part of it. The Blackett Equation seemed to show that the same formula also applied to gravity. If the figures we collected on the magnetic field strength of Jupiter forced us to retire the Dirac equations, then none of the rest of the information we've gotten from the Bridge would have been worth the money we spent to get it. On the other hand, Jupiter was the only body in the solar system available to us which was big enough in all relevant respects to make it possible for us to test those equations at all. They involve quantities of enormous orders of magnitudes.

"And the figures show that Dirac was right. *They also show that Blackett was right.* Both magnetism *and* gravity are phenomena of rotation.

"I won't bother to trace the succeeding steps, because I think you can work them out for yourself. It's enough to say that there's a drive-generator on board this ship which is the complete and final justification of all the hell you people on the Bridge gang have been put through. The gadget has a long technical name, but the technies who tend it have already nicknamed it the spindizzy, because of what it does to the magnetic moment of any atom—*any* atom—within its field.

"While it's in operation, it absolutely refuses to notice any atom outside its own influence. Furthermore, it will notice no other strain or influence which holds good beyond the borders of that field. It's so snooty that it has to be stopped down to almost nothing when it's brought close to a planet, or it won't let you land. But in deep space . . . well, it's impervious to meteors and such trash, of course; it's impervious to gravity; and—it hasn't the faintest interest in any legislation about top speed limits."

"You're kidding," Helmuth said.

"Am I, now? This ship came to Ganymede directly from Earth. It did it in a little under two hours, counting maneuvering time."

Helmuth took a defiant pull at his drink. "This thing really has no top speed at all?" he said. "How can you be sure of that?"

"Well, we can't," Wagoner admitted. "After all, one of the unfortunate things about general mathematical formulas is that they don't contain cut-off points to warn you of areas where they don't apply. Even quantum mechanics is somewhat subject to that criticism. However, we expect to know pretty soon just how fast the spindizzy can drive an object, if there is any limit. We expect you to tell us."

"I?"

"Yes, Helmuth, you. The coming debacle on Earth makes it absolutely imperative for us—the West—to get interstellar expeditions started at once. Richardson Observatory, on the Moon, has two likely-looking systems picked out already—one at Wolf 359, another at 61 Cygni—and there are sure to be hundreds of others where Earth-like planets are highly probable. We want to scatter adventurous people, people with a thoroughly indoctrinated love of being free, all over this part of the galaxy, if it can be done.

"Once they're out there, they'll be free to flourish, with no interference from Earth. The Soviets haven't the spindizzy yet, and even after they steal it from us, they won't dare allow it to be used. It's too good and too final an escape route.

"What we want you to do . . . now I'm getting to the point, you see . . . is to direct this exodus. You've the intelligence and the cast of mind for it. Your analysis of the situation on Earth confirms that, if any more confirmation were needed. And—there's no future for you on Earth now."

"You'll have to excuse me," Helmuth said, firmly. "I'm in no condition to be reasonable now; it's been more than I could digest in a few moments. And the decision doesn't entirely rest with me, either. If I could give you an answer in . . . let me see . . . about three hours. Will that be soon enough?"

"That'll be fine," the senator said.

"And so, that's the story," Helmuth said.

Eva remained silent in her chair for a long time.

"One thing I don't understand," she said at last. "Why did you come to me? I'd have thought that you'd find the whole thing terrifying."

"Oh, it's terrifying, all right," Helmuth said, with quiet exultation. "But terror and fright are two different things, as I've just discovered. We were both wrong, Evita. I was wrong in thinking that the Bridge was a dead end. You were wrong in

thinking of it as an end in itself."

"I don't understand you."

"All right, let's put it this way: The work the Bridge was doing was worth-while, as I know now—so I was wrong in being frightened of it, in calling it a bridge to nowhere.

"But you no more saw where it was going than I, and you made the Bridge the be-all and end-all of your existence.

"Now, there's a place to go to; in fact there are places—hundreds of places. They'll be Earthlike places. Since the Soviets are about to win Earth, those places will be more Earthlike than Earth itself, for the next century or so at least!"

She said, "Why are you telling me this? Just to make peace between us?"

"I'm going to take on this job, Evita, if you'll go along?"

She turned swiftly, rising out of the chair with a marvelous fluidity of motion. At the same instant, all the alarm bells in the station went off at once, filling every metal cranny with a jangle of pure horror.

"*Posts!*" the speaker above Eva's bed roared, in a distorted, gigantic version of Charity Dillon's voice. "*Peak storm overload! The STD is now passing the Spot. Wind velocity has already topped all previous records, and part of the land mass has begun to settle. This is an A-1 overload emergency.*"

Behind Charity's bellow, the winds of Jupiter made a spectrum of continuous, insane shrieking. The Bridge was responding with monstrous groans of agony. There was another sound, too, an almost musical cacophony of sharp, percussive tones, such as a dinosaur might make pushing its way through a forest of huge steel tuning-forks. Helmuth had never heard that sound before, but he knew what it was.

The deck of the Bridge was splitting up the middle.

After a moment more, the uproar dimmed, and the speaker said, in Charity's normal voice, "Eva, you too, please. Acknowledge, please. This is it—unless everybody comes on duty at once, the Bridge may go down within the next hour."

"Let it," Eva responded quietly.

There was a brief, startled silence, and then a ghost of a human sound. The voice was Senator Wagoner's, and the sound just might have been a chuckle.

Charity's circuit clicked out.

The mighty death of the Bridge continued to resound in the little room.

After a while, the man and the woman went to the window, and looked past the discarded bulk of Jupiter at the near horizon, where there had always been visible a few stars.

THE END

The Horsehead Nebula—dust in incalculable quantities, the dust between the stars—shows that our own Galaxy is as foggy and as much swept by the dust-winds as are the others we see.

BIRTHPLACE FOR PLANETS

BY HOWARD L. MYERS

***Richardson** recently wrote on Turbulence; here an amateur cosmologist suggests a way in which a colossal turbulence, known to exist, might lead to the making of suns and planets.*

Photographs: Mount Wilson Observatory

The question has been asked and answered in many ways: How was the Earth created? Mythology blamed the deed on a variety of gods. Science attempts to replace the gods with natural forces. Laplace pictured around the sun a great shrinking globe of gas, dropping off rings of matter to congeal into planets as its size diminished. Chamberlin and Moulton and others suggested that the planets were the resulting wreckage of a stellar traffic accident of some sort. These hypotheses have been remodeled and polished in more recent years, but as yet no account of planetary evolution has been received as compatible with known natural laws.

This is a statement of yet another possible solution of the problem of planetary origin. Since a hypothesis should have a name, I call it the Galactic Articulation hypothesis. And, like Laplace, I offer it "with that diffidence which ought always to attach to whatever is not the result of observation or of calculation." Moreover, I welcome criticism.

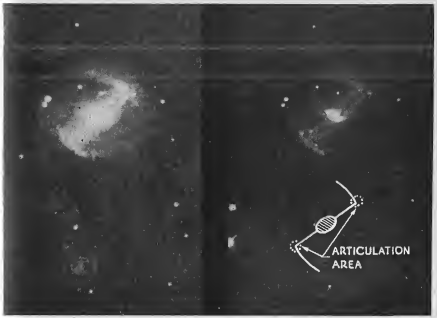
The solar system is not especially complicated, nor is it, on the other hand, too simple and barren to contain hints concerning the nature of its birth process. Possibly the nature of this process has not been discovered because the hypotheses have invariably placed the sun in an environment generally similar to the one it now has. In such a setting, where stars are separated by several light-years of black emptiness, the theorists gave the sun another star or a gas cloud, and waited expectantly for the birth pains to start. They got nothing but abortions.

Let us take a look at the galaxy and see what sort of surroundings the sun probably really had some three billion years ago, that is, a billion years before geologists believe the Earth's oldest sedimentary rocks to have been formed. To do this, we will have to infer quite a bit from what our telescopes show of other galactic systems, and try to superimpose this information on what little we can see of our own Milky Way.

The vast majority of large galaxies have rotational symmetry. Some of these star masses are fairly solid-looking ellipsoids, ranging from almost spherical forms to thin lens shapes. The thinnest of these systems present as a cross-section an ellipse of .07 eccentricity. This amount of eccentricity appears to be the limit beyond which a galactic system cannot be stable in the ellipse state.

The systems with rotational symmetry are usually spirals, however. In these the nucleus has two major star streams projecting from opposite edges and spiraling away from the system's center. It seems logical to assume that this is the normal shape of a rotating galaxy in which the speed of rotation overbalances the galactic gravity sufficiently to cause the eccentricity of the system to pass the E7 limit. By way of illustration, if the rotation of the Earth should gradually become faster, the planet would begin flattening at the poles and finally the ground at the bulging equator would attain escape velocity and fly off into space. If, in addition, there were longitudinal tidal bulges on opposite sides of the planet, most of the departing material would break away from the high points where the tidal bulges crossed the equatorial bulge, and we would have two arms of earth spiraling away from opposite longitudes of the equator.

In a spiral galaxy, such as astronomers believe ours to be, the nucleus is far denser than are the spiral arms. In almost all photographs of other spiral systems this fact is obvious. Supporting evidence is the globular clusters of our own system, which may be considered as lumps in the pudding—chunks of nucleus that have managed to resist attenuation in the process of leaving the nucleus. Within these clusters, stars are separated by light-minutes rather than light-years. In our nucleus, then, we have stars separated by no more than planetary



Two plates of the Barred Spiral nebula (N.G.C. 5383, Canes Venatici) taken with different expasures. The basically gassy-dusty nature of Galaxies is shown in the longer (left) exposure; the structure of the barred spiral is clearer in the shorter.

distances, like present binary stars.

Apparently the arms actually are being projected from a rotating mass due to a force similar at least to centrifugality. This is evident from the fact that the arms remain unbroken in spite of the fact that the period of rotation of the nucleus is shorter than it is for the arms in many neighboring spirals. In other words, since old arm material is constantly being left behind by rotational speed, new arm material must be constantly leaving the nucleus in order to maintain continuous arms.

In our galaxy, the period of galactic revolution at the sun's present position has been estimated at something more than two hundred million years. The period of rotation for the nucleus we assume to be less. The galaxy has made approximately ten turns since Earth's earliest sedimentary deposits were laid.

Let's go back some three billion years and take a look around. Let's go into the galactic nucleus and settle down on a particular bit of stellar matter and await developments. Pretty hot here—good thing we didn't bring our bodies along. Looking upward from our star we see almost unbroken whiteness—the neighboring stars are so close together that their disks overlap. If our star revolves, we see a section of sky that is a little mottled. Patches of very light gray show between some of the star disks in this section, which leads us to believe that our observation post is near the nuclear rim. We are puzzled over the gaps not being outer-space black, but our spectroscope—we happened to bring one along—tells us that these spots are filled with highly ionized atoms of iron, calcium, and other elements. The spectrum lines are those for what was once called *coronium*, the substance of coronas. Further investigation shows us that the vacuum between nuclear stars is thick with ionized atoms of every element on the chart. In "cold" space these atoms would soon cool off and drop back to their parent suns, but here there is little chance for them to lose their ionization charges with nearby suns streaming hard radiations at them from all directions. We call this ionized matter *coronium* for convenience.

As time passes more gray spots appear. We find that our star is moving closer to the rim of the nucleus. We are going into an arm—or maybe we're already in the arm—it's hard to tell from our position. The stars around us are shifting restlessly. To the rimward they seem to be slowing up and hanging back, while towards the galactic center they maintain full speed. Our star, between the two movements, is influenced by both. The rimside stars each give it a little backward tug as they are passed, and as it is slowed down the centerward stars try to speed it up again. Tidal

The Smooth Spiral type (M51, N.G.C. 5194, Canes *Venatici*) is articulated close to the central nucleus.

bulges, set up by these passing bodies, cause our star to rotate. Also they start the *coronium* swirling around our star. There is quite a bit of this revolving *coronium*, we notice, extending out several light-hours from our equator. This belt of ionized atoms passes closer to the neighbors than does our star and feels the brunt of their gravity fields as well as absorbing some frictional thrust from their own *coronium* sheaths. In fact, we conclude, after taking careful observations, our star's oversized corona has acquired hundreds of times more angular momentum than the star itself has.

Realizing this, we view each other with wild surmise. "Eureka!" someone shouts. This, we know, is a very important spot in the galaxy, and after some debate we decide to call it the *area of galactic articulation*. It is the place where one section of the galaxy is jointed to another. As in most flexible joints, some friction is involved. The outer material, which has escaped into a spiral arm, is no

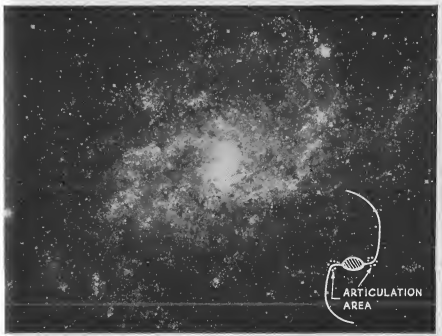
longer rotating as if a solid part of the nucleus, but revolves around it with a longer period. As each new star leaves the nucleus it is obliged to act as a ball bearing of sorts between the nucleus and the outer material until it becomes a part of the outer material. The *coronium* sheath of each star normally goes through this process of absorbing angular momentum from contrasting galactic movements as its adopted stellar body passes through the area of articulation.

Is this area really at the edge of the nucleus? As we can't tell from our observation point we are forced to speculate. In some galactic systems the inner portions of the arms appear to rotate as a solid part of the nucleus. Such spirals do not show smooth outward curves—they first stream straight away from the center, and then bend abruptly as if they were for the first time free from the restraining solidity of the nuclear mass. In the "barred" spirals the arms go straight out from the center for almost the full diameter of the system, then make right angle turns and proceed to form a circle around the nucleus. Since we are not sure which category our spiral fits—smooth, angular, or barred—all we can say is that the articulation area is at that point where matter ceases to rotate with the nucleus and begins to revolve around it.

Let's see what our star is up to now. It seems to have more elbow room than formerly—its neighbors are now light-days away instead of hours or minutes. Even then there is a great flood of light coming from the entire sky.

The coronium sheath captures our attention. No longer affected appreciably by gravity or friction from the neighbors, it is now influenced mainly by the gravity and light of our star and light of other stars. These forces have varying effects on its different elements. The heavier atoms, such as iron, are attracted relatively more by our star's gravity and repelled relatively less by its light pressure than are the lighter atoms, such as hydrogen. Thus, a sorting process takes place in the great disk of ionized particles, with the heavy atoms tending to circle closer to the star and the light ones farther out. This sorting is far from thorough. The angular momentum is not the same for all the atoms of any given element and they cannot all gather at the same distance from the star. Light from neighboring bodies also disrupts this sorting.

While this is going on, the atoms begin to loose their ionization charges since the total present radiant energy is far less than it was in the nucleus. Here and there two tired atoms bump into each other and lack the strength to bounce apart. Another atom joins them, and then another similar colony. Soon a particle of matter with appreciable mass is formed—enough to cast a shadow, even though a microscopic one.

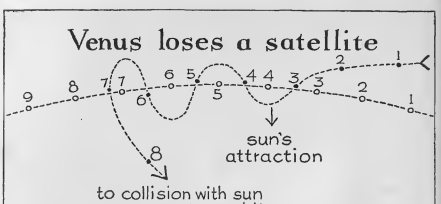


Angled Spiral (M33, N.G.C. 598, *Triangulum*) has articulation areas just beyond the nucleus proper. But comes the question: Is our own Galaxy a Barred, Smooth or Angled spiral?

This shadow is important. Remember, the surrounding stars are still close enough to cause a flow of light pressure from all sides. Under such conditions a solid nonradiant body breaks the balance of radiant power on the atoms in its vicinity and the atoms dive for the hole in the pressure created by the body like dust for an air vent. The body grows rapidly.

By growing the body becomes less affected by light pressure than by gravity. It seeks a new orbital distance from the star that balances the star's attraction against the body's angular momentum; this momentum, of course, representing the total former momentum of its atomic particles. It falls some distance toward the star —this fall being gradual as mass is acquired—and its orbit develops some degree of eccentricity. As it is not revolving at the same speed nor in quite the same direction as are the remaining loose atoms, it continually approaches and picks up more of them.

The body also runs across smaller



bodies like itself and pulls them in, but sometimes the lesser body refuses to fall and goes into business as a satellite, trying to compete with the older and larger firm in capturing the atomic customers. The autocratic sun is on the side of big business, and when the new planet and its satellite are near enough the star dislodges the satellite from its orbit. A large planetary body at some distance from the star can capture and keep a sizable retinue of satellites.

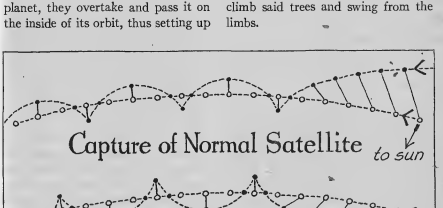
The vast majority of particles lie very near the plane of the ecliptic and approach the new planetary body either from the inside or the outside of the body's orbit. Generally, those approaching from the outside have the most angular momentum—since most of them were nearer to, and more influenced by, the neighbor stars in the articulation area. Thus, the side of the planet away from the sun is constantly being pushed ahead as new mass is added, and as a result the planet rotates in the same direction in which it revolves.

We notice that the satellites usually revolve about their primaries in the same direction in which the planets circle the sun. Since they go through the same formative process as did their primaries, only later, they are usually captured when they fall toward the sun to adjust their orbits. Most of them, if their sizes are of any consequence, form at a greater distance from the sun, than did their primaries, because the belt where the primary developed was swept relatively clean of building material. Therefore, the satellite has more angular momentum for its mass than does its chosen planet. As it falls sunward, it comes under the influence of the planet's gravity, which supplements that of the sun to pull it closer than it originally intended to come. Until influenced by the planet, the satellite had the longer period of revolution. Hence, it was overtaken by the planet. Its first crossing of the planet's orbit is made ahead of the planet —if it is to become a stable satellite— thus establishing itself in an orbit similar to the planet's in direction.

A few minor satellites are retrograde in their revolutions and their small sizes suggest that they had pretty lean pickings in their formative area, either near or inside their planet's orbit or slightly outside the ecliptic plane. Their angular momentum is less for their mass than is that of their primary, indicating that they must have tried to establish themselves inside the planet's orbit originally with shorter revolutionary periods. When attracted into an orbit around the planet, they overtake and pass it on the inside of its orbit, thus setting up their revolutionary motion as retrograde.

While this process is going on, all the nonradiating bodies are still being enlarged by atomic particles. The bodies farther from the sun capture relatively more light elements and fewer heavy elements than do the inner planets. Beyond the planetary system, the neighboring stars are continuing to recede as the stellar material in the galactic arm disperses. After a while, their light pressure ceases to be an important force in the new planetary system, and many of the remaining free particles are pushed into outer space by the sun's radiance.

Much of the energy accumulated in the planets by their formation is dispersed as heat. They crust over and some of them grow trees and things to climb said trees and swing from the limbs.



Let us sum up this whole process in a chronological outline:

I Pre-Articulation

A. The sun is a "particle" in the rotating mass of the galactic nucleus. It is separated by light-minutes from its nearest star neighbors. Stellar relationships are at random. Between the stars is an "atmosphere" of ionized atoms.

B. The sun's movements carry it near the rim of the nucleus and toward one of the articulation areas at the base of—or some distance out—one of the spirals. Surrounding conditions do not change appreciably, although the neighboring stars may recede slightly.

II Articulation

A. The sun reaches the break-away point where stellar material is freed from nuclear solidity.

B. Previously freed stars moving backward relative to the sun and nuclear stars moving forward exert opposing forces on opposite sides of the sun and its sheath. The sheath especially receives a great deal of angular momentum, which flattens it into a thin disk extending out several light-hours from the sun's equator. While this is happening, the neighbor stars are dispersing more and more—they are now light-days from the sun.

C. Moving farther away from the nucleus, the sun and its neighbors leave the area of articulation and become part of the freely revolving spiral. Stellar relationships again become random. Within the sun's sheath the atoms are being sorted with the heavier elements tending sunward while the lighter ones stay farther away.

III Post-Articulation

A. The neighbor stars are still close enough to exert omnidirectional light pressure on atomic particles. But since the total radiant energy is decreased, the sheath atoms begin losing their ionizing charges and join into bits of solid matter.

B. These bits of matter form shadows into which more atoms are pushed by the light pressure. As a planetary body grows, its shadow becomes capable of collecting atoms from greater and greater distances.

C. As an embryo planet gains mass, its movements become more independent of light pressure. Thus, the planet drops some distance sunward to compensate this pressure loss. It continues to grow, and the kinetic energy of falling atoms is diffused as heat.

D. Smaller bodies which form later are sometimes captured as satellites by a planet, usually when they drop toward the sun to adjust their orbits.

E. The receding neighbors move to light-year distances. The planetary system is complete.

That, then, is the Galactic Articulation Hypothesis of Planetary Evolution. It is on the whole so simple and—to me—logical that I can hardly believe no one has thought of it before. Being pretty much in the realm of pure speculation, it probably cannot be definitely proved or disproved—only credited or discredited.

Some of the solar system's phenomena are not explained by this scheme, but it seems to account for the major problems. The formation of the asteroid belt and Saturn's rings could be due to later incidents of a more accidental nature, for instance. The extreme orbital eccentricity of the Uranian satellites in relation to the plane of the ecliptic suggests that all was not peaches and cream in the articulation area. Possibly a star passed too close to the flattened atomic sheath and warped the Uranian sector out of kilter.

If the hypothesis is true as stated, planetary systems come about as a normal result of galactic forces, and our local system is not a lonely product of some fortuitous set of circumstances. Almost every star that has passed as a unit through the area of articulation should have a family of planets more or less like our own. Since the various planetary systems got their building material from the possibly homogeneous nuclear *coronium*, they may resemble each other in chemical make-up rather than agreeing with that of their suns. Differences of gravity and radiant pressure from sun to sun will of course have some influence, but essentially planets are children of the galaxy rather than of the nursemaid stars they circle.

Stars that pass through the articulation area as members of groups, that is, as binaries or as clusters, would not have planetary systems like ours. Some of them may have planets of sorts, but hardly large, stable, smooth-running systems. We do not know what percentage of the single stars in our sky are not actually members of open clusters, but the number of them may be extremely large.

In a sense this hypothesis kicks the question of creation upstairs. While the solar system got its momentum charge as a by-product of galactic spiraling, where did the galaxy get enough angular momentum to start throwing off a spiral in the first place? By shrinking? Or by maintaining its size while the universe as a whole expanded?

Reminds me of the wheels Ezekiel is said to have seen "a-turning, way up in the middle of the air." While our little wheel—the planetary system—is run by motion acquired from the big wheel—the galaxy—rather than by faith, I am still inclined to let "the big wheel run by the grace of God."

THE END

SYMBOLIC LOGIC AND METAMATHEMATICS

BY CRISPIN KIM-BRADLEY

A discussion wherein the interesting idea is brought out that there are things which are true, and yet cannot be proven true—and it can be proven that their truth can never be proven!

An old subject, which has been comparatively stagnant for centuries, has taken on new life. Logic, which in the hands of the medieval followers of Aristotle had been shackled to the study of the syllogism, has undergone a profound and rigorous transformation which has elevated it to a position of prominence and import among the sciences. In a few short years it has climbed from a comparatively trivial field, concerned largely with the analysis and codification of results originating in antiquity, to a vigorous new field, wherein important discoveries are being made daily and whose influence had already been felt markedly in the foundations of mathematics and the physical sciences.

Today we stand, with respect to logic, where the age of Galileo and Newton stood with respect to the coming development of physics, or where Lobatchevsky and Riemann stood with respect to geometry. The new logic has so far outstripped the classical Aristotelian logic in power and breadth of scope that the connection between the two is hardly discernible. In this there is an analogy to the arithmetic of primitive tribes as compared to modern mathematics.

To distinguish it from traditional logic, modern logic is known in the literature by the various appellations *symbolic logic, mathematical logic, logistic,* et cetera. The first of these reflects the complete symbolization so characteristic of the subject and in which lies the source of its power. Mathematicians discovered long ago that without the adoption of new and more versatile ideographic symbols little progress could be made because no human mind could grasp the necessary relationships in terms of the phonograms of ordinary language. But even today much of the deductive technique of modern mathematics, other than that which involves the rote manipulation of the mathematical symbols, is carried out on a relatively primitive verbal level as is evident by the large verbal content of most mathematical publications.

Also, to avoid verbosity, many tacit steps in deduction are left to the ingenuity of the reader even when they may not be immediately apparent. This can be remedied by the application of the techniques of symbolic logic with which the most minute detail of a deduction could be symbolized. A mathematician might justify a certain step in a mathematical argument, verbally, as follows: "Between any two numbers I can always find a third." Or, more precisely: "For any x, and any y, there is a z such that, if x is less than y then z is greater than x but smaller than y." The logician, on the other hand, would symbolize the content of this passage as follows:

$$(x)\,(y)\,(Ez)\,(x < y \supset x < z < y).$$

The germ of the idea of a symbolic calculus can be traced at least as far back as Leibnitz—1646–1716—the eminent German philosopher-mathematician and co-discoverer, with Newton, of the calculus, whose dream it was to found a universal calculus of reasoning which would provide a mechanical solution to any mathematical problem. This *calculus ratiocinator,* as he called it, would reduce all reasoning to a species of calculation, and more—it would by its very nature actually guide and direct the calculator toward the desired deductions. But the historical importance of Leibnitz lies less in any positive contributions than in his prophetic insight and in the stimulus his ideas exercised upon other minds.

The first important contribution to the actual development of the subject was made by George Boole, an obscure British mathematician and schoolteacher, with the publication in 1854 of his work "The Laws of Thought." Bertrand Russell has remarked that pure mathematics was *discovered* by Boole in this work. In it he established the foundations of what is now known as the propositional calculus, concerning which we will have more to say later, and thus took the first step toward the realization of the Leibnizian dream. He actually reduced reasoning to a kind of calculation—but not all reasoning. Beyond a certain level a method was still lacking.

Subsequent writers, among them De Morgan, E. Schröder, and C. S. Peirce,

took to and elaborated the new algebra of logic and brought it to a fairly high degree of perfection. Then in the last quarter of the nineteenth century a little known German philosopher, Gottlob Frege, published a series of works, "*Begriffsschrift, Die Grundlagen der Arithmetik,*" and "*Grundgesetze der Arithmetik,*" works of a very remarkable and profound nature. In these works Frege showed that arithmetic and other fundamental parts of mathematics were actually branches of logic; i.e., certain notions which prior to that time were held to be purely mathematical in nature—the notions of number, function, sum, product, power, limit, derivative, et cetera—could be rigorously defined in terms of a few elementary notions of logic—the notions of class, identity, relation, "and," "or," "if . . . then," et cetera. This was a remarkable discovery indeed. Concepts which had eluded exact definition for centuries succumbed to Frege's penetrating analysis. Mankind had been employing some of these notions, the idea of number for example, since prehistory, yet in a sense it might be said that Frege was the first person to know what a number really is.

What was the secret method, the key, to this all powerful analysis? It was a system of symbolic logic, invented by Frege himself, which advanced beyond the propositional calculus of Boole and entered the realm of what is known as the functional calculi and quantification theory, on which we will elaborate later. With this invention Frege completed the program of reducing all formal reasoning to one comprehensive system.

It might be thought that works of such fundamental importance would be eagerly and immediately embraced by the scientific, mathematical, and philosophical world. But unfortunately this was not the case. Frege had invented a symbolism in which to couch his seminal ideas, a symbolism which was difficult and erudite. The intricacy of his symbolism prevented his work receiving the immediate recognition it deserved and its significance went, for a time, unnoticed.

But not for long. Others were thinking along the same lines. The Italian mathematician, Giuseppe Peano, looking about for a device with which to expound his notions on the foundations of the number system and finding none, invented his own symbolism. Fortunately it took a very neat and richly suggestive form, quickly grasped by the eye and mind. Then in 1900, while attending an international congress of philosophy in Paris, Bertrand Russell and Alfred North Whitehead, two eminent British philosophers, learned of Peano's system and were struck by the superiority of his ideograms over all other existing symbolisms.

Experimenting with the new symbolism, Russell was able to discover, quite independently of Frege, the definition of number and other fundamental mathematical concepts. He conceived the idea that perhaps *all* of mathematics, not only arithmetic, could be reduced to logic. Together with Whitehead he undertook the program of so reducing mathematics, thus showing that mathematics and logic are one and the same. The fruit of their collaboration, the monumental and epoch-making "*Principia Mathematics*" was published in three volumes in 1910–1913. With this work symbolic logic emerged from adolescence and became a completely mature science.

The Propositional Calculus

If we consider the various ways in which statements, or propositions, are combined and transformed in ordinary language, we find that most of them can be reduced to four or five fundamental modes. Thus two statements b and c can be combined by the word "and," symbolized by a dot, to form a compound statement b.c (read "b and c"). If b stands for the statement "The birds are singing" and c for "The corn is ripe" then b.c would symbolize the compound statement "The birds are singing and the corn is ripe." This mode of combining statements is called *conjunction* and the conjunction of two statements is to be regarded as true only if both statements are true. Thus conjunction has the following *truth table:*

b	c	b.c
T	T	T
F	T	F
T	F	F
F	F	F

The table is interpreted by reading horizontally as follows: If b is true and c is true, then b.c is true; if b is false but c is true, then b.c is false, et cetera.

An operation which affects a single statement is the operation of denial, which in ordinary language is usually expressed with the word "not," and in modern logic is symbolized by the tilde "~". Thus, to revert to our previous example, if we wish to symbolize the statement "The birds are not singing" we do so with the symbol ~b (read "not-b"). This is called *negation*, and the negation of a true statement is false, whereas the negation of a false statement is true. Thus negation has the following, self-explanatory, truth table:

b	~b
T	F
F	T

The two operations, conjunction and negation, can be combined in various ways to give various compound statements. Thus "The birds are not singing but the corn is ripe" would be rendered ~ b.c, whereas "It is not the case that the birds are singing and the corn is not ripe" becomes ~ (b. ~ c), et cetera.

A third method of statement com-

position, *alternation*, is rendered most often in ordinary language by the word "or," and is symbolized by the sign "∨". To express the statement "Either the birds are singing or the corn is ripe (or both)" we use b ∨ c (read "b or c"). An alternation of two statements is true as long as one or both statements are true. It is false only if both statements are false. The truth table becomes:

b	c	b ∨ c
T	T	T
F	T	T
T	F	T
F	F	F

Two other modes of statement composition commonly used in the propositional calculus are the *conditional* and *biconditional*, symbolized by "⊃" and "≡" respectively. The conditional is most closely rendered by the idiom "if . . . then" and the biconditional by "if and only if." "If the birds are singing then the corn is ripe" would become b ⊃ c (read "if b then c"), and "The birds are singing if and only if the corn is ripe" would be rendered b ≡ c (read "b if and only if c"). A conditional, b ⊃ c, is regarded as false if b is true while c is false, otherwise it is true. A biconditional, b ≡ c, is true as long as b and c are simultaneously true or simultaneously false. If one statement is true while the other is false, the biconditional itself is false. From these definitions the reader can readily construct his own truth tables for the conditional and biconditional.

From these five fundamental statement connectives more complex statements can be built up at pleasure, and the corresponding truth tables constructed by reference to the fundamental ones. A little experimentation with these symbols quickly reveals the fact that some statement compounds are always true, independently of the truth or falsity of their constituents. As an illustration consider the statement "Either it is raining in Washington or it is not" which we symbolize by r ∨ ∼ r. Common sense tells us that the statement is always true regardless of the weather conditions in Washington. A truth table analysis would, of course, reveal the same fact. If we construct a truth table for the formula r ∨ ∼ r by reference to the previously given tables for alternation and negation the result is as follows:

r	∼ r	r ∨ ∼ r
T	F	T
F	T	T

For if r is true then ∼ r is false. But the alternation r ∨ ∼ r would then be true because one component (namely r) is true, and reference to our truth table for b ∨ c shows that an alternation is true as long as one component is true. On the other hand if r is false then ∼ r is true, and again r ∨ ∼ r is true because this time the other component ∼ *r* is true.

A formula such as r ∨ ∼ r, possessing the property of being true regardless of the truth or falsity of r, is called a *tautology*. The literature of logic abounds with examples of tautologies. Some examples are:

(1) ∼ (a. ∼ a)
(2) (a.b) ⊃ b
(3) ∼ ∼ a ≡ a

These correspond respectively to the logical laws:

(1) A statement cannot be both true and false.
(2) If both a and b are true, then b is true.
(3) A double negative yields a positive assertion.

Tautologies, while very important for providing steps in logical deductions, possess an air of triviality about them by dint of the fact that they reveal no new information. Thus the above example "Either it is raining in Washington or it is not" is certainly always true but gives no meteorological data concerning the nation's capitol.

This example is trivial in another respect—it is obvious. Not all tautologies, however, suffer from this second species of triviality. Truth table analysis will reveal, for example, that the formula (t.m) ∨ (t. ∼ b) ∨ (∼ t.b) ∨ (∼ t.p) ∨ (∼ m.b) ∨ (∼ b. ∼ p) is tautological. If we let t stand for "Tom is going to the movies," and m stand for "Mary is going to the movies," and similarly for Bob (b) and Pat (p), then our formula may be translated "Either Tom and Mary are going to the movies, or Tom is going and Bob is not, or Tom is not and Bob is, or Tom is not and Pat is, or Mary is not and Bob is, or Bob is not and neither is Pat". In view of the tautological nature of our formula, the statement will always be true, no matter what Tom, Mary, Bob, and Pat decide to do. But purely verbal analysis will avail little in revealing its tautological character. The statement, although a tautology, is far from obvious.

The method of truth tables provides then a completely mechanical check on the validity of any formula of the propositional calculus. In this particular domain of logic the Leibnizian dream has come true. Reasoning has been reduced to a kind of calculation. Because of the purely routine nature of the calculations involved one might suspect that a machine could be devised to carry out the operations. And this is indeed the case. In recent years Theodore Kalin and William Burkhart of the Harvard Computation Laboratory have constructed just such a machine, and another is under development at the University of Manchester, England. Thus at the level of the propositional calculus, human intelligence and ingenuity may give way to unreasoning, robotlike calculation.

The main theoretical utility of the propositional calculus is to provide steps in the deductive schemes necessary at higher levels of logic. But the

propositional calculus has recently found application in circuit analysis, in consistency tests for insurance contracts and public opinion polls, and elsewhere. But undoubtedly the most important applications are yet to come.

Quantification Theory and Metamathematics

But the propositional calculus by no means comprises the whole of modern logic. There are many sound inferences for which the techniques of this calculus are inadequate. For example, starting with the statement "Not all things have mass" we may wish to deduce the statement "Some things do not have mass." For we feel certain that "If not all A's are B's, then some A's are not B's" will always be true no matter how A and B are interpreted.

This example has, superficially, the appearance of a conditional and we might attempt to symbolize it by letting p stand for "All things have mass" and q for "Some things have mass." Then "If not all things have mass, then some things do not have mass" becomes ($\sim$ p $\supset$ $\sim$ q). But this formula, which we would expect to be a tautology, is easily found by truth table analysis not to be. Indeed the formula turns out to be false if p is false and q is true.

The difficulty lies in the fact that the truth of our example does not follow from its superficial structure as a conditional, but is hidden in its finer structure, specifically in the words "all" and "some." Hence if logic is to cope with this situation appropriate rules must be set up for handling the idioms of ordinary language which involve these words. A first step is the symbolization of these concepts.

In modern logic a statement such as "All things have mass" would first be reworded into the form: The statement "x has mass" is true for all values of x. Or, more briefly, "For any x, x has mass." Similarly the statement "Some things do not have mass" would be reworded to "There exist x's for which x does not have mass." We can symbolize the statement "x has mass" by the symbol M(x). Then "x does not have mass" becomes $\sim$ M(x). The expression "for any x" is symbolized by (x) and is known in logic as the *universal quantifier*. "There exist x's for which—" is symbolized by (Ex) and is known as the *existential quantifier*.

So finally "All things have mass" becomes (x)M(x) and "Some things do not have mass" becomes (Ex) $\sim$ M(x). Our problem, the deduction of the conclusion "Some things do not have mass" from the premise "Not all things have mass" is reduced to the derivation of the formula (Ex) $\sim$ M(x) from the formula $\sim$ (x) M(x).

But where does this lead? We still cannot apply the method of truth tables to the new form of our example and so we are apparently no better off than before. The truth of the matter is that once we begin to examine the fine structure of statements, as we have done here, the method of truth tables must be abandoned in favor of more adequate techniques. These techniques depend upon a set of postulates and rules of derivation by means of which we are able to derive or *prove* true statements. Thus one rule might be stated as follows: A tilde can be transposed past a universal quantifier provided that the universal quantifier is replaced by an existential quantifier. So the rule tells that $\sim$ (x) may validly be rewritten as (Ex) $\sim$. Hence an application of this rule enables us to derive the formula (Ex) $\sim$ M(x) from the formula $\sim$ (x)M(X), and our problem is solved.

We cannot go into the question of what rules and postulates have been set down for the *functional calculus*, as this branch of logic is called, but in practice the rules for deriving valid statements are usually simpler and more obvious than that stated above. We will now compare the results in this field with those in the propositional calculus.

In the propositional calculus we saw that given any statement compound we have, in the method of truth tables, a perfectly mechanical routine by which we can decide whether the statement compound is valid. We have what is known as a *decision procedure* for the propositional calculus. What is the corresponding state of affairs with regard to the functional calculus? Here again we have a method for determining validity. We start with our postulates and rules of derivation and try to derive the statement we are testing. If we succeed in finding a derivation, we know that our statement is true.

But what if we fail? Then the question concerning the validity of our statement is still unsettled. Two possibilities present themselves. Either the statement is not valid, or it is valid but we lack sufficient ingenuity to prove it. Either possibility would account for our failure to find a proof. A decision procedure is lacking for the functional calculus, and proving statements therein is not merely a matter of routine but entails an element of luck and ingenuity.

This is an unfortunate state of affairs, and we might hope that with the passage of time the situation might be alleviated and a decision procedure found, so that the functional calculus might come under the Leibnizian program. But unfortunately this cannot be. Professor Alonzo Church of Princeton has shown that no mechanical routine can ever decide validity in the functional calculus. In other words, Professor Church has proven that certain problems cannot be solved by machines, that intelligence is necessary. To establish this result he used certain methods and results of a field

of logic called *metamathematics* or the theory of proof, a field developed by Kurt Gödel of the Institute for Advanced Study at Princeton.

But the outlook is not quite as dark as it seems. Although a mechanical test for validity is unobtainable, there does exist a mechanical routine whereby any proof, once it is found, can be checked. In effect, proofs can be written in such a way that they could be checked by a robot. Hence the functional calculus is half mechanical in this sense. Man and machine can collaborate, men furnishing the proofs of theorems and machines checking these proofs for possible errors. Also, Gödel has shown, using metamathematical methods, that the functional calculus is *complete* in the sense that for every valid theorem there does exist a proof, whether or not we can find it.

When Frege, Russell, Whitehead and others embarked on their program of reducing mathematics to logic, they soon discovered that not even the functional calculus was adequate, and they had to deal with higher functional calculi, namely the *calculus of classes* and the *theory of relations*. It would take us too far afield to give examples here, but we will indicate what metamathematics has to say concerning these fields.

Gödel has proven the truly remarkable fact that, not only is a decision procedure lacking here, but, what is far worse, the class calculus and relation theory are not complete nor completable. This means that it is possible to formulate mathematical theorems which are valid but which, even in theory, it is impossible to prove, for no proof can exist. No combination of man and machine will suffice to find a proof here for there is nothing to find. Gödel was actually able to construct arithmetical theorems which are true but unprovable. This remarkable fact came as a shock to mathematical preconceptions. For if anything is more remarkable than the fact that certain theorems are unprovable, it is the fact that Gödel was actually able to prove that they are unprovable.

Bibliography

In attempting to give an overall view of modern logic, from the foundations to the frontier, we have had, of necessity, to omit mention of many important topics, multi-valued logic for example. The interested reader will find an already extensive, and rapidly growing, literature. We list below a few books which, in their entirety or in their opening chapters, are most suited to the needs of beginners.

Cooley, J. C. "A Primer of Formal Logic." New York, 1942

Quine, W. V. "Mathematical Logic." New York, 1940; "Methods of Logic." New York, 1950

Reichenbach, H. "Elements of Symbolic Logic." New York, 1947

Tarski, A. "Introduction to Logic." New York, 1941

THE END

". . . Man that is born of woman hath but a short time to live and is full of misery. He cometh up and is cut down, like a flower; he fleeth as it were a shadow and never continueth in one stay—"

The voice of the chaplain was small and sharp in the thin air, intoning the words of the burial service above the temporary lectern set up just inside the transparent wall of the landing field dome. Through the double transparencies of the dome and the plastic cover of the burial rocket the black-clad ranks could see the body of the dead stationman, Ted Waskewicz, lying back comfortably at an angle of forty-five degrees, peaceful in death, waxily perfect from the hands of the embalmers, and immobile. The eyes were closed, the cheerful, heavy features still held their expression of thoughtless dominance, as though death had been a minor incident, easily shrugged off; and the battle star made a single blaze of color on the tunic of the black uniform.

"Amen." The response was a deep bass utterance from the assembled men, like the single note of an organ. In the front rank of the Cadets, Thomas Jordan's lips moved stiffly with the others', his voice joining mechanically in their chorus. For this was the moment of his triumph, but in spite of it, the old, old fear had come back, the old sense of loneliness and loss and terror of his own inadequacy.

He stood at stiff attention, eyes to the front, trying to lose himself in the unanimity of his classmates, to shut out the voice of the chaplain and the memory it evoked of an alien raid on an undefended city and of home and parents swept away from him in a breath. He remembered the mass burial service read over the shattered ruin of the city; and the government agency that had taken him—a ten-year-old orphan—and given him care and training until this day, but could not give him what these others about him had by natural right—the courage of those who had matured in safety.

For he had been lonely and afraid since that day. Untouched by bomb or shell, he had yet been crippled deep inside of him. He had seen the enemy in his strength and run screaming from his spacesuited gangs. And what could give Thomas Jordan back his soul after that?

But still he stood rigidly at attention, as a Guardsman should; for he was a soldier now, and this was part of his duty.

The chaplain's voice droned to a halt. He closed his prayerbook and stepped back from the lectern. The captain of the training ship took his place.

"In accordance with the conventions of the Frontier Force," he said, crisply, "I now commit the ashes of Station Commandant First Class, Theodore Waskewicz, to the keeping of time and space."

He pressed a button on the lectern. Beyond the dome, white fire blossomed out from the tail of the burial rocket, heating the asteroid rock to temporary incandescence. For a moment it hung there, spewing flame. Then it rose, at first slowly, then quickly, and was gone, sketching a fiery path out and away, until, at almost the limits of human sight, it vanished in a sudden, silent explosion of brilliant light.

Around Jordan, the black-clad ranks relaxed. Not by any physical movement, but with an indefinable breaking of nervous tension, they settled themselves for the more prosaic conclusion of the ceremony. The relaxation reached even to the captain, for he about-faced with a relieved snap and spoke to the ranks.

"Cadet Thomas Jordan. Front and center."

The command struck Jordan with an icy shock. As long as the burial service had been in progress, he had had the protection of anonymity among his classmates around him. Now, the captain's voice was a knife, cutting him off, finally and irrevocably from the one security his life had known, leaving him naked and exposed. A despairing numbness seized him. His reflexes took over, moving his body like a robot. One step forward, a right face, down to the end of the row of silent men, a left face, three steps forward. Halt. Salute.

"Cadet Thomas Jordan reporting, sir."

"Cadet Thomas Jordan, I hereby invest you with command of this Frontier Station. You will hold it until relieved. Under no conditions will you enter into communications with an enemy nor allow any creature or vessel to pass through your sector of space from Outside."

"Yes, sir."

"In consideration of the duties and responsibilities requisite on assuming command of this Station, you are promoted to the rank and title of Station Commandant Third Class."

"Thank you, sir."

From the lectern the captain lifted a cap of silver wire mesh and placed it on his head. It clipped on to the electrodes already buried in his skull, with a snap that sent sound ringing through his skull. For a second, a sheet of lightning flashed in front of his eyes and he seemed to feel the weight of the memory bank already pressing on his mind. Then lightning and pressure vanished together to show him the captain offering his hand.

"My congratulations, commandant."

"Thank you, sir."

They shook hands, the captain's grip quick, nervous and perfunctory. He took one abrupt step backward and transferred his attention to his second in command.

"Lieutenant! Dismiss the formation!"

It was over. The new rank locked itself around Jordan, sealing up the fear and loneliness inside him. Without listening to the barked commands that no longer concerned him, he turned on his heel and strode over to take up his position by the sally port of the training ship. He stood formally at attention beside it, feeling the weight of his new authority like a heavy cloak on his thin shoulders. At one stroke he had become the ranking officer present. The officers—even the captain—were nominally under his authority, so long as their ship remained grounded at his Station. So rigidly he stood at attention that not even the slightest tremor of the trembling inside him escaped to quiver betrayingly in his body.

They came toward him in a loose, dark mass that resolved itself into a single file just beyond saluting distance. Singly, they went past him and up the ladder into the sally port, each saluting him as they passed. He returned the salutes stiffly, mechanically, walled off from these classmates of six years by the barrier of his new command. It was a moment when a smile or a casual handshake would have meant more than a little. But protocol had stripped him of the right to familiarity; and it was a line of black-uniformed strangers that now filed slowly past. His place was already established and theirs was yet to be. They had nothing in common any more.

The last of the men went past him up the ladder and were lost to view through the black circle of the sally port. The heavy steel plug swung slowly to, behind them. He turned and made his way to the unfamiliar but well-known field control panel in the main control room of the Station. A light glowed redly on the communications board. He thumbed a switch and spoke into a grill set in the panel.

"Station to Ship. Go ahead."

Overhead the loudspeaker answered.

"Ship to Station. Ready for takeoff."

His fingers went swiftly over the panel. Outside, the atmosphere of the field was evacuated and the dome slid back. Tractor mechs scurried out from the pit, under remote control, clamped huge magnetic fists on the ship, swung it into launching position, then retreated.

Jordan spoke again into the grill.

"Station clear. Take-off at will."

"Thank you, Station." He recognized the captain's voice. "And good luck."

Outside, the ship lifted, at first slowly, then faster on its pillar of flame, and dwindled away into the darkness of space. Automatically, he closed the dome and pumped the air back in.

He was turning away from the control panel, bracing himself against the moment of finding himself completely isolated, when, with a sudden, curious shock, he noticed that there was another, smaller ship yet on the field.

For a moment he stared at it blankly, uncomprehendingly. Then memory returned and he realized that the ship was a small courier vessel from Intelligence, which had been hidden by the huge bulk of the training ship. Its officer would still be below, cutting a record tape of the former commandant's last memories for the file at Headquarters. The memory lifted him momentarily from the morass of his emotions to attention to duty. He turned from the panel and went below.

In the triply-armored basement of the Station, the man from Intelligence was half in and half out of the memory bank when he arrived, having cut away a portion of the steel casing around the bank so as to connect his recorder direct to the cells. The sight of the heavy mount of steel with the ragged incision in one side, squatting like a wounded monster, struck Jordan unpleasantly; but he smoothed the emotion from his face and walked firmly to the bank. His footsteps rang on the metal floor; and the man from Intelligence, hearing them, brought his head momentarily outside the bank for a quick look.

"Hi!" he said, shortly, returning to his work. His voice continued from the interior of the bank with a friendly, hollow sound. "Congratulations, commandant."

"Thanks," answered Jordan, stiffly. He stood, somewhat ill at ease, uncertain of what was expected of him. When he hesitated, the voice from the bank continued.

"How does the cap feel?"

Jordan's hands went up instinctively to the mesh of silver wire on his head. It pushed back unyieldingly at his fingers, held firmly on the electrodes.

"Tight," he said.

The Intelligence man came crawling out of the bank, his recorder in one hand and thick loops of glassy tape in the other.

"They all do at first," he said, squatting down and feeding one end of the tape into a spring rewind spool. "In a couple of days you won't even be able to feel it up there."

"I suppose."

The Intelligence man looked up at him curiously.

"Nothing about it bothering you, is there?" he asked. "You look a little strained."

"Doesn't everybody when they first start out?"

"Sometimes," said the other, noncommittally. "Sometimes not. Don't hear a sort of humming, do you?"

"No."

"Feel any kind of pressure inside your head?"

"No."

"How about your eyes. See any spots or flashes in front of them?"

"No!" snapped Jordan.

"Take it easy," said the man from Intelligence. "This is my business."

"Sorry."

"That's all right. It's just that if there's anything wrong with you or the bank I want to know it." He rose from the rewind spool, which was now industriously gathering in the loose tape; and unclipping a pressure-torch from his belt, began resealing the aperture. "It's just that occasionally new officers have been hearing too many stories about the banks in Training School, and they're inclined to be jumpy."

"Stories?" said Jordan.

"Haven't you heard them?" answered the Intelligence man. "Stories of memory domination—stationmen driven insane by the memories of the men who had the Station before them. Catatonics whose minds have got lost in the past history of the bank, or cases of memory replacement where the stationman has identified himself with the memories and personality of the man who preceded him."

"Oh, those," said Jordan. "I've heard them." He paused, and then, when the other did not go on: "What about them? Are they true?"

The Intelligence man turned from the half-resealed aperture and faced him squarely, torch in hand.

"Some," he said bluntly. "There's been a few cases like that; although there didn't have to be. Nobody's trying to sugar-coat the facts. The memory bank's nothing but a storehouse connected to you through your silver cap—a gadget to enable you not only to remember everything you ever do at the station, but also everything anybody else who ever ran the Station, did. But there've been a few impressionable stationmen who've let themselves get the notion that the memory bank's a sort of a coffin with living dead men crawling around inside it. When that happens, there's trouble."

He turned away from Jordan, back to his work.

"And that's what you thought was the trouble with me," said Jordan, speaking to his back.

The man from Intelligence chuckled—it was an amazingly human sound.

"In my line, fella," he said, "we check all possibilities." He finished his resealing and turned around.

"No hard feelings?" he said.

Jordan shook his head. "Of course not."

"Then I'll be getting along." He bent over and picked up the spool, which had by now neatly wound up all the tape, straightened up and headed for the ramp that led up from the basement to the landing field. Jordan fell into step beside him.

"You've nothing more to do, then?" he asked.

"Just my reports. But I can write those on the way back." They went up the ramp and out through the lock on to the field.

"They did a good job of repairing the battle damage," he went on, looking around the Station.

"I guess they did," said Jordan. The two men paced soberly to the sally port of the Intelligence ship. "Well, so long."

"So long," answered the man from Intelligence, activating the sally port mechanism. The outer lock swung open and he hopped the few feet up to the opening without waiting for the little ladder to wind itself out. "See you in six months."

He turned to Jordan and gave him a casual, offhand salute with the hand holding the wind-up spool. Jordan returned it with training school precision. The port swung closed.

He went back to the master control room and the ritual of seeing the ship off. He stood looking out for a long time after it had vanished, then turned from the panel with a sigh to find himself at last completely alone.

He looked about the Station. For the next six months this would be his home. Then, for another six months he would be free on leave while the Station was rotated out of the line in its regular order for repair, reconditioning, and improvements.

If he lived that long.

The fear, which had been driven a little distance away by his conversation with the man from Intelligence, came back.

If he lived that long. He stood, bemused.

Back to his mind with the letter-perfect recall of the memory bank came the words of the other. Catatonic—cases of memory replacement. Memory domination. Had those others, too, had more than they could bear of fear and anticipation?

And with that thought came a suggestion that coiled like a snake in his mind. That would be a way out. What if they came, the alien invaders, and Thomas Jordan was no longer here to meet them? What if only the catatonic hulk of a man was left? What if they came and a man was here, but that man called himself and knew himself only as—

Waskewicz!

"No!" the cry came involuntarily from his lips; and he came to himself with his face contorted and his hands half-extended in front of him in the attitude of one who wards off a ghost. He shook his head to shake the vile suggestion from his brain; and leaned back, panting, against the control panel.

Not that. Not ever that. He had surprised in himself a weakness that turned him sick with horror. Win or lose; live or die. But as Jordan—not as any other.

He lit a cigarette with trembling fingers. So—it was over now and he was safe. He had caught it in time. He had his warning. Unknown to him—all this time—the seeds of memory domination must have been lying waiting within him. But now he knew they were there, he knew what meas-

ures to take. The danger lay in Waskewicz's memories. He would shut his mind off from them—would fight the Station without the benefit of their experience. The first stationmen on the line had done without the aid of a memory bank and so could he.

So.

He had settled it. He flicked on the viewing screens and stood opposite them, very straight and correct in the middle of his Station, looking out at the dots that were his forty-five doggie mechs spread out on guard over a million kilometers of space, looking at the controls that would enable him to throw their blunt, terrible, mechanical bodies into battle with the enemy, looking and waiting, waiting, for the courage that comes from having faced squarely a situation, to rise within him and take possession of him, putting an end to all fears and doubtings.

And he waited so for a long time, but it did not come.

The weeks went swiftly by; and that was as it should be. He had been told what to expect, during training; and it was as it should be that these first months should be tense ones, with a part of him always stiff and waiting for the alarm bell that would mean a doggie signaling sight of an enemy. It was as it should be that he should pause, suddenly, in the midst of a meal with his fork halfway to his mouth, waiting and expecting momentarily to be summoned; that he should wake unexpectedly in the nighttime and lie rigid and tense, eyes fixed on the shadowy ceiling and listening. Later—they had said in training—after you have become used to the Station, this constant tension will relax and you will be left at ease, with only one little unobtrusive corner of your mind unnoticed but forever alert. This will come with time, they said.

So he waited for it, waited for the release of the coiled springs inside him and the time when the feel of the Station would be comfortable and friendly about him. When he had first been left alone, he had thought to himself that surely, in his case, the waiting would not be more than a matter of days; then, as the days went by and he still lived in a state of hair-trigger sensitivity, he had given himself, in his own mind, a couple of weeks—then a month.

But now a month and more than a month had gone without relaxation coming to him; and the strain was beginning to show in nervousness of his hands and the dark circles under his eyes. He found it impossible to sit still either to read, or to listen to the music that was available in the Station library. He roamed restlessly, endlessly checking and rechecking the empty space that his doggies' viewers revealed.

For the recollection of Waskewicz as he lay in the burial rocket would not go from him. And that was not as it should be.

He could, and did, refuse to recall the memories of Waskewicz that he had never experienced; but his own personal recollections were not easy to control and slipped into his mind when he was unaware. All else that he could do to lay the ghost, he had done. He had combed the Station carefully, seeking out the little adjustments and conveniences that a lonely man will make about his home, and removed them, even when the removal meant a loss of personal comfort. He had locked his mind securely to the storehouse of the memory bank, striving to hold himself isolated from the other's memories until familiarity and association should bring him to the point where he instinctively felt that the Station was *his* and not the other's. And, whenever thoughts of Waskewicz entered in spite of all these precautions, he had dismissed them sternly, telling himself that his predecessor was not worth the considering.

But the other's ghost remained, intangible and invulnerable, as if locked in the very metal of the walls and floor and ceiling of the Station; and rising to haunt him with the memories of the training school tales and the ominous words of the man from Intelligence. At such times,

when the ghost had seized him, he would stand paralyzed, staring in hypnotic fascination at the screens with their silent mechanical sentinels, or at the cold steel of the memory bank, crouching like some brooding monster, fear feeding on his thoughts — until, with a sudden, wrenching effort of the will, he broke free of the mesmerism and flung himself frantically into the duties of the Station, checking and rechecking his instruments and the space they watched, doing anything and everything to drown his wild emotions in the necessity for attention to duty.

And eventually he found himself almost hoping for a raid, for the test that would prove him, would lay the ghost, one way or another, once and for all.

It came at last, as he had known it would, during one of the rare moments when he had forgotten the imminence of danger. He had awakened in his bunk, at the beginning of the arbitrary ten-hour day; and lay there drowsily, comfortably, his thoughts vague and formless, like shadows in the depths of a lazy whirlpool, turning slowly, going no place.

Then—the alarm!

Overhead the shouting bell burst into life, jerking him from his bed. Its metal clangor poured out on the air, tumbling from the loudspeakers in every room all over the Station, strident with urgency, pregnant with disaster. It roared, it vibrated, it thundered, until the walls themselves threw it back, seeming to echo in sympathy, acquiring a voice of their own until the room rang—until the Station itself rang like one monster bell, calling him into battle.

He leaped to his feet and ran to the master control room. On the telltale high on the wall above the viewer screens, the red light of number thirty-eight doggie was flashing ominously. He threw himself into the operator's seat before it, slapping one palm hard down on the switch to disconnect the alarm.

The Station is in contact with the enemy.

The sudden silence slapped at him, taking his breath away. He gasped and shook his head like a man who has had a glassful of cold water thrown unexpectedly in his face; then plunged his fingers at the keys on the master control board in front of his seat—Up beams. Up detector screen, established now at forty thousand kilometers distance. Switch on communications to Sector Headquarters.

The transmitter purred. Overhead, the white light flashed as it began to tick off its automatic signal. "Alert! Alert! Further data follows. Will report."

Headquarters has been notified by Station.

Activate viewing screen on doggie number thirty-eight.

He looked into the activated screen, into the vast arena of space over which the mechanical vision of that doggie mech was ranging. Far and far away at top magnification were five small dots, coming in fast on a course leading ten points below and at an angle of thirty-two degrees to the Station.

He flicked a key, releasing thirty-eight on proximity fuse control and sending it plunging toward the dots. He scanned the Station area map for the positions of his other mechs. Thirty-nine was missing—in the Station for repair. The rest were available. He checked numbers forty through forty-five and thirty-seven through thirty to rendezvous on collision course with enemy at seventy-five thousand kilometers. Numbers twenty to thirty to rendezvous at fifty thousand kilometers.

Primary defense has been inaugurated.

He turned back to the screen. Number thirty-eight, expendable in the interests of gaining information, was plunging towards the ships at top acceleration under strains no living flesh would have been able to endure. But as yet the size and type of the invaders was still hidden by distance. A white light flashed abruptly from the communications panel, announcing that Sector Headquarters was alerted and ready to talk. He cut in audio.

"Contact. Go ahead, Station J-49C3."

"Five ships," he said. "Beyond identification range. Coming in through thirty-eight at ten point thirty-two."

"Acknowledge," the voice of Headquarters was level, precise, emotionless. "Five ships—thirty-eight—ten—thirty-two. Patrol Twenty, passing through your area at four hours distance, has been notified and will proceed to your station at once, arriving in four hours, plus or minus twenty minutes. Further assistance follows. Will stand by here for your future messages."

The white light went out and he turned away from communications panel. On the screen, the five ships had still not grown to identifiable proportions, but for all practical purposes, the preliminaries were over. He had some fifteen minutes now during which everything that could be done, had been done.

Primary defense has been completed.

He turned away from the controls and walked back to the bedroom, where he dressed slowly and meticulously in full black uniform. He straightened his tunic, looking in the mirror and stood gazing at himself for a long moment. Then, hesitantly, almost as if against his will, he reached out with one hand to a small gray box on a shelf beside the mirror, opened it, and took out the silver battle star that the next few hours would entitle him to wear.

It lay in his palm, the bright metal

winking softly up at him under the reflection of the room lights and the small movements of his hand. The little cluster of diamonds in its center sparked and ran the whole gamut of their flashing colors. For several minutes he stood looking at it; then slowly, gently, he shut it back up in its box and went out, back to the control room.

On the screen, the ships were now large enough to be identified. They were medium sized vessels, Jordan noticed, of the type used most by the most common species of raiders—that same race which had orphaned him. There could be no doubt about their intentions, as there sometimes was when some odd stranger chanced upon the Frontier, to be regretfully destroyed by men whose orders were to take no chances. No, these were *the enemy*, the strange, suicidal life form that thrust thousands of attacks yearly against the little human empire, who blew themselves up when captured and wasted a hundred ships for every one that broke through the guarding stations to descend on some unprotected city of an inner planet and loot it of equipment and machinery that the aliens were either unwilling or unable to build for themselves—a contradictory, little understood and savage race. These five ships would make no attempt to parley.

But now, doggie number thirty-eight had been spotted and the white exhausts of guided missiles began to streak toward the viewing screen. For a few seconds, the little mech bucked and tossed, dodging, firing defensively, shooting down the missiles as they approached. But it was a hopeless fight against those odds and suddenly one of the streaks expanded to fill the screen with glaring light.

And the screen went blank. Thirty-eight was gone.

Suddenly realizing that he should have been covering with observation from one of the doggies further back, Jordan jumped to fill his screens. He brought the view from forty in on the one that thirty-eight had vacated and filled the two flanking screens with the view from thirty-seven on his left and twenty on his right. They showed his first line of defense already gathered at the seventy-five kilometer rendezvous and the fifty thousand kilometer rendezvous still forming.

The raiders were decelerating now, and on the wall, the telltale for the enemy's detectors flushed a sudden deep and angry purple as their invisible beams reached out and were baffled by the detector screen he had erected at a distance of forty thousand kilometers in front of the Station. They continued to decelerate, but the blockage of their detector beams had given them the approximate area of his Station; and they corrected course, swinging in until they were no more than two points and ten degrees in error. Jordan, his nervous fingers trembling slightly on the keys, stretched

thirty-seven through thirty out in depth and sent forty through forty-five forward on a five-degree sweep to attempt a circling movement.

The five dark ships of the raiders, recognizing his intention, fell out of their single file approach formation to spread out and take a formation in open echelon. They were already firing on the advancing doggies and tiny streaks of light tattooed the black of space around numbers forty through forty-five.

Jordan drew a deep and ragged breath and leaned back in his control seat. For the moment there was nothing for his busy fingers to do among the control keys. His thirties must wait until the enemy came to them; since, with modern automatic gunnery the body at rest had an advantage over the body in motion. And it would be some minutes before the forties would be in attack position. He fumbled for a cigarette, keeping his eyes on the screens, remembering the caution in the training manuals against relaxation once contact with the enemy had been made.

But reaction was setting in.

From the first wild ringing command of the alarm until the present moment, he had reacted automatically, with perfection and precision, as the drills had schooled him, as the training manuals had impressed upon him. The enemy had appeared. He had taken measures for defense against them. All that could have been done had been done; and he knew he had done it properly. And the enemy had done what he had been told they would do.

He was struck, suddenly, with the deep quivering realization of the truth in the manual's predictions. It was so, then. These inimical others, these alien foes, were also bound by the physical laws. They as well as he, could move only within the rules of time and space. They were shorn of their mystery and brought down to his level. Different and awful, they might be, but their capabilities were limited, even as his; and in a combat such as the one now shaping up, their inhumanness was of no account, for the inflexible realities of the universe weighed impartially on him and them alike.

And with this realization, for the first time, the old remembered fear began to fall away like a discarded garment. A tingle ran through him and he found himself warming to the fight as his forefathers had warmed before him away back to the days when man was young and the tiger roared in the cool, damp jungle-dawn of long ago. The blood-instinct was in him; that and something of the fierce, vengeful joy with which a hunted creature turns at last on its pursuer. He would win. Of course he would win. And in winning he would at one stroke pay off the debt of blood and fear which the enemy had held

against him these fifteen years.

Thinking in this way, he leaned back in his seat and the old memory of the shattered city and of himself running, running, rose up again around him. But this time it was no longer a prelude to terror, but fuel for the kindling of his rage. *These are my fear,* he thought, gazing unseeingly at the five ships in the screens *and I will destroy them.*

The phantasms of his memory faded like smoke around him. He dropped his cigarette into a disposal slot on the arm of his seat, and leaned forward to inspect the enemy positions.

They had spread out to force his forties to circle wide, and those doggies were now scattered, safe but ineffective, waiting further directions. What had been an open echelon formation of the raiders was now a ragged, widely dispersed line, with far too much space between ships to allow each to cover his neighbor.

For a moment Jordan was puzzled; and a tiny surge of fear of the unexplicable rippled across the calm surface of his mind. Then his brow smoothed out. There was no need to get panicky. The aliens' maneuver was not the mysterious tactic he had half-expected it to be; but just what it appeared, a rather obvious and somewhat stupid move to avoid the flanking movement he had been attempting with his forties. Stupid—because the foolish aliens had now rendered themselves vulnerable to interspersal by his thirties.

It was good news, rather than bad, and his spirits leaped another notch.

He ignored the baffled forties, circling automatically on safety control just beyond the ships' effective aiming range; and turned to the thirties, sending them plunging toward the empty areas between ships as you might interlace the fingers of one hand with another. Between any two ships there would be a dead spot—a position where a mech could not be fired on by either vessel without also aiming at its right- or left-hand companion. If two or more doggies could be brought safely to that spot, they could turn and pour down the open lanes on proximity control, their fuses primed, their bomb loads activated, blind bulldogs of destruction.

One third, at least, should in this way get through the defensive shelling of the ships and track their dodging prey to the atomic flare of a grim meeting.

Smiling now in confidence, Jordan watched his mechs approach the ships. There was nothing the enemy could do. They could not now tighten up their formation without merely making themselves a more attractive target; and to disperse still further would negate any chance in the future of regaining a semblance of formation.

Carefully, his fingers played over the keys, gentling his mechs into line so that they would come as close as possible to hitting their dead spots simultaneously. The ships came on.

Closer the raiders came, and closer. And then—bare seconds away from contact with the line of approaching doggies, white fire ravened in unison from their stern tubes, making each ship suddenly a black nugget in the center of a blossom of flame. In unison, they spurted forward, in sudden and unexpected movement, bringing their dead spots to and past the line of seeking doggies, leaving them behind.

Caught for a second in stunned surprise, Jordan sat dumb and motionless, staring at the screen. Then, swift in his anger, his hands flashed out over the keys, blasting his mechs to a cruel, shuddering halt, straining their metal sinews for the quickest and most abrupt about face and return. This time he would catch them from behind. This time, going in the same direction as the ships, the mechs could not be dodged. For what living thing could endure equal strains with cold metal?

But there was no second attempt on the part of the thirties, for as each bucked to its savage halt, the rear weapons of the ships reached out in unison, and each of the blasting mechs, that had leaped forward so confidently, flared up and died like little candles in the dark.

Numb in the grip of icy failure, Jordan sat still, a ramrod figure staring at the two screens that spoke so eloquently of his disaster—and the one dead screen where the view from thirty-seven had been, that said nothing at all. Like a man in a dream, he reached out his right hand and cut in the final sentinel, the *watchdog,* that mech that circled closest to the Station. In one short breath his strong first line was gone, and the enemy rode, their strength undiminished, floating in toward his single line of twenties at fifty thousand with the defensive screen a mere ten thousand kilometers behind them.

Training was strong. Without hesitation his hands went out over the keys and the doggies of the twenties surged forward, trying for contact with the enemy in an area as far from the screen as possible. But, because they were moving in on an opponent relatively at rest, their courses were the more predictable on the enemy's calculators and the disadvantage was theirs. So it was that forty minutes later three ships of the alien rode clear and unthreatened in an area where two of their mates, the forties and all of the thirties were gone.

The ships were, at this moment, fifteen thousand kilometers from the detector screen.

Jordan looked at his handiwork. The situation was obvious and the alternatives undeniable. He had twenty doggies remaining, but he had neither the time to move them up beyond the screen, nor the room to maneuver them in front of it. The only answer

was to pull his screen back. But to pull the screen back would be to indicate, by its shrinkage and the direction of its withdrawal, the position of his Station clearly enough for the guided missiles of the enemy to seek him out; and once the Station was knocked out, the doggies were directionless, impotent.

Yet, if he did nothing, in a few minutes the ships would touch and penetrate the detector screen and his Station, the nerve center the aliens were seeking, would lie naked and revealed in their detectors.

He had lost. The alternatives totaled to the same answer, to defeat. In the inattention of a moment, in the smoke of a cigarette, the first blind surge of self-confidence and the thoughtless halting of his by-passed doggies that had allowed the ships' calculators to find them stationary for a second in a predictable area, he had failed. He had given away, in the error of his pride, the initial advantage. He had lost. Speak it softly, speak it gently, for his fault was the fault of one young and untried. He was defeated.

And in the case of defeat, the actions prescribed by the manual was stern and clear. The memory of the instructions tolled in his mind like the unvarying notes of a funeral bell.

"When, in any conflict, the forces of the enemy have obtained a position of advantage such that it is no longer possible to maintain the anonymity of the Station's position, the commandant of the Station is required to perform one final duty. Knowing that the Station will shortly be destoyed and that this will render all remaining mechs innocuous to enemy forces, the commandant is commanded to relinquish control of these mechs, and to place them with fuses primed on proximity control, in order that, even without the Station, they may be enabled to automatically pursue and attempt to destroy those forces of the enemy that approach within critical range of their proximity fuse."

Jordan looked at his screens. Out at forty thousand kilometers, the detector screen was beginning to luminesce slightly as the detectors of the ships probed it at shorter range. To make the manual's order effective, it would have to be pulled back to at least half that distance; and there, while it would still hide the Station, it would give the enemy his approximate location. They would then fire blindly, but with cunning and increasing knowledge and it would be only a matter of time before they hit. After that—only the blind doggies, quivering, turning and trembling through all points of the stellar compass in their thoughtless hunger for prey. One or two of these might gain a revenge as the ships tried to slip past them and over the Line; but Jordan would not be there to know it.

But there was no alternative—even if duty had left him one. Like strangers, his hands rose from the board and stretched out over the keys that would turn the doggies loose. His fingers dropped and rested upon them—light touch on smooth polished coolness.

But he could not press them down.

He sat with his arms outstretched, as if in supplication, like one of his primitive forebearers before some ancient altar of death. For his will had failed him and there was no denying now his guilt and his failure. For the battle had turned in his short few moments of inattention, and his underestimation of the enemy that had seduced him into halting his thirties without thinking. He knew; and through the memory bank—if that survived—the Force would know. In his neglect, in his refusal to avail himself of the experience of his predecessors, he was guilty.

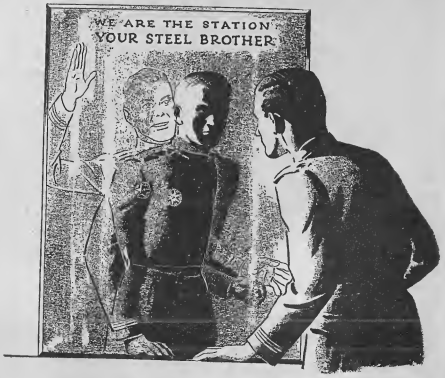
And yet, he could not press the keys. He could not die properly—*in the execution of his duty*—the cold, correct phrase of the official reports. For a wild rebellion surged through his young body, an instinctive denial of the end that stared him so undeniably in the face. Through vein and sinew and nerve, it raced, opposing and blocking the dictates of training, the logical orders of his upper mind. It was too soon, it was not fair, he had not been given his chance to profit by experience. One more opportunity was all he needed, one more try to redeem himself.

But the rebellion passed and left him shaken, weak. There was no denying reality. And now, a new shame came to press upon him, for he thought of the three alien vessels breaking through, of another city in flaming ruins, and another child that would run screaming from his destroyers. The thought rose up in him, and he writhed internally, torn by his own indecisions. Why couldn't he act? It made no difference to him. What would justification and the redeeming of error mean to him after he was dead?

And he moaned a little, softly to himself, holding his hands outstretched above the keys, but could not press them down.

And then hope came. For suddenly, rising up out of the rubble of his mind came the memory of the Intelligence man's words once again, and his own near-pursuit of insanity. He, Jordan, could not bring himself to expose himself to the enemy, not even if the method of exposure meant possible protection for the Inner Worlds. But the man who had held this Station before him, who had died as he was about to die, must have been faced with the same necessity for self-sacrifice. And those last-minute memories of his decision would be in the memory bank, waiting for the evocation of Jordan's mind.

Here was hope at last. He would remember, would embrace the insanity he had shrunk from. He would remember and be Waskewicz, not Jor-



dan. He would be Waskewicz and unafraid; though it was a shameful thing to do. Had there been one person, one memory among all living humans, whose image he could have evoked to place in opposition to the images of the three dark ships, he might have managed by himself. But there had been no one close to him since the day of the city raid.

His mind reached back into the memory bank, reached back to the last of Waskewicz's memories. He remembered.

Of the ten ships attacking, six were down. Their ashes strewed the void and the remaining four rode warily, spread widely apart for maximum safety, sure of victory, but wary of this hornet's nest which might still have some stings yet unexpended. But the detector screen was back to its minimum distance for effective concealment and only five doggies remained poised like blunt arrows behind it. He—Waskewicz—sat hunched before the control board, his thick and hairy hands lying softly on the proximity keys.

"Drift in," he said, speaking to the ships, which were cautiously approaching the screen. "Drift in, you. Drift!"

His lips were skinned back over his teeth in a grin—but he did not mean it. It was an automatic grimace, reflex to the tenseness of his waiting. He would lure them on until the last moment, draw them as close as possible to the automatic pursuit mechanisms of the remaining doggies, before pulling back the screen.

"Drift in," he said.

They drifted in. Behind the screen he aimed his doggies, pointing each one of four at a ship and the remaining one generally at them all. They drifted in.

They touched.

His fingers slapped the keys. The screen snapped back until it barely covered the waiting doggies. And the doggies stirred, on proximity, their pursuit mechs activated, now blind and terrible fully armed, ready to attack in senseless directness anything that came close enough.

And the first shells from the advancing ships began to probe the general area of the Station asteroid.

Waskewicz sighed, pushed himself back from the controls and stood up, turning away from the screens. It was over. Done. All finished. For a moment he stood irresolute; then, walking over to the dispenser on the wall, dialed for coffee and drew it, hot into a disposable cup. He lit a cigarette and stood waiting, smoking and drinking the coffee.

The Station rocked suddenly to the impact of a glancing hit on the asteroid. He staggered and slopped some coffee on his boots, but kept his feet. He took another gulp from the cup, another drag on the cigarette. The Station shook again, and the lights dimmed. He crumpled the cup and dropped it in the disposal slot. He dropped the cigarette on the steel floor, ground it beneath his boot sole; and walked back to the screen and leaned over for it for a final look.

The lights went out. And memory ended.

The present returned to Jordan and he stared about him a trifle wildly. Then he felt hardness beneath his fingers and forced himself to look down.

The keys were depressed. The screen was back. The doggies were on proximity. He stared at his hand as if he had never known it before, shocked at its thinness and the lack of soft down on its back. Then, slowly, fighting reluctant neck muscles, he forced himself to look up and into the viewing screen.

And the ships were there, but the ships were drawing away.

He stared, unable to believe his eyes, and half-ready to believe anything else. For the invaders had turned and the flames from their tails made it evident that they were making

away into outer space at their maximum bearable acceleration, leaving him alone and unharmed. He shook his head to clear away the false vision from the screen before him, but it remained, denying its falseness. The miracle for which his instincts had held him in check had come—in the moment in which he had borrowed strength to deny it.

His eyes searched the screens in wonder. And then, far down in one corner of the watch dog's screen and so distant still that they showed only as pips on the wide expanse, he saw the shape of his miracle. Coming up from inside of the Line under maximum bearable acceleration were six gleaming fish-shapes that would dwarf his doggies to minnows—the battleships of Patrol Twenty. And he realized, with the dawning wonder of the reprieved, that the conflict, which had seemed so momentary while he was fighting it had actually lasted the four hours necessary to bring the Patrol up to his aid.

The realization that he was now safe washed over him like a wave and he was conscious of a deep thankfulness swelling up within him. It swelled up and out, pushing aside the lonely fear and desperation of his last few minutes, filling him instead with a relief so all-encompassing and profound that there was no anger left in him and no hate—not even for the enemy. It was like being born again.

Above him on the communications panel, the white message light was blinking. He cut in on the speaker with a steady hand and the dispassionate, official voice of the Patrol sounded over his head.

"Patrol Twenty to Station. Twenty to Station. Come in Station. Are you all right?"

He pressed the transmitter key.

"Station to Twenty. Station to Twenty. No damage to report. The Station is unharmed."

"Glad to hear it, Station. We will not pursue. We are decelerating now and will drop all ships on your field in half an hour. That is all."

"Thank you, Twenty. The field will be clear and ready for you. Land at will. That is all."

His hand fell away from the key and the message light winked out. In unconscious imitation of Waskewicz's memory he pushed himself back from the controls, stood up, turned and walked to the dispenser in the wall, where he dialed for and received a cup of coffee. He lit a cigarette and stood as the other had stood, smoking and drinking. He had won.

And reality came back to him with a rush.

For he looked down at his hand and saw the cup of coffee. He drew in on the cigarette and felt the hot smoothness of it deep in his lungs. And terror took him twisting by the throat.

He had won? He had done nothing. The enemy ships had fled not from him, but from the Patrol; and it was Waskewicz, *Waskewicz*, who had taken the controls from his hands at the crucial moment. It was Waskewicz who had saved the day, not he. It was the memory bank. The memory bank and Waskewicz!

The control room rocked about him. He had been betrayed. Nothing was won. Nothing was conquered. It was no friend that had broken at last through his lonely shell to save him, but the mind-sucking figment of memory-domination sanity. The memory bank and Waskewicz had seized him in their grasp.

He threw the coffee container from him and made himself stand upright. He threw the cigarette down and ground it beneath his boot. White-hot, from the very depths of his being, a wild anger blazed and consumed him. *Puppet*, said the mocking voice of his conscience, whispering in his ear. *Puppet!*

Dance, Puppet! Dance to the tune of the twitching strings!

"No!" he yelled. And, borne on the white-hot tide of his rage, the all-consuming rage that burnt the last trace of fear from his heart like dross from the molten steel, he turned to face his tormentor, hurling his mind backward, back into the life of Waskewicz, prisoned in the memory bank.

Back through the swirling tide of memories he raced, hunting a point of contact, wanting only to come to grips with his predecessor, to stand face to face with Waskewicz. Surely, in all his years at the Station, the other must sometime have devoted a thought to the man who must come after him. Let Jordan just find that point, there where the influence was strongest, and settle the matter, for sanity or insanity, for shame or pride, once and for all.

"Hi, Brother!"

The friendly words splashed like cool water on the white blaze of his anger. He—Waskewicz—stood in front of the bedroom mirror and his face looked out at the man who was himself, and who yet was also Jordan.

"Hi, Brother!" he said. "Whoever and wherever you may be. Hi!"

Jordan looked out through the eyes of Waskewicz, at the reflected face of Waskewicz; and it was a friendly face, the face of a man like himself.

"This is what they don't tell you," said Waskewicz. "This is what they don't teach in training—the message that, sooner or later, every stationman leaves for the guy who comes after him.

"This is the creed of the Station. *You are not alone.* No matter what happens, *you are not alone.* Out on the rim of the empire, facing the unknown races and the endless depths of the universe, this is the one thing that will keep you from all harm. As long as you remember it, nothing can affect you, neither attack, nor defeat, nor death. Light a screen on your outermost doggie and turn the magni-

fication up as far as it will go. Away out at the limits of your vision you can see the doggie of another Station, of another man who holds the Line beside you. All along the Frontier, the Outpost Stations stand, forming a link of steel to guard the Inner Worlds and the little people there. They have their lives and you have yours; and yours is to stand on guard.

"It is not easy to stand on guard; and no man can face the universe alone. But—*you are not alone!* All those who at this moment keep the Line, are with you; and all that have ever kept the Line, as well. For this is our new immortality, we who guard the Frontier, that we do not stop with our deaths, but live on in the Station we have kept. We are in its screens, its controls, in its memory bank, in the very bone and sinew of its steel body. *We are the station,* your steel brother that fights and lives and dies with you and welcomes you at last to our kinship when for your personal self the light has gone out forever, and what was individual of you is nothing any more but cold ashes drifting in the eternity of space. *We are with you and of you, and you are not alone.* I, who was once Waskewicz, and am now part of the Station, leave this message for you, as it was left to me by the man who kept this guard before me, and as you will leave it in your turn to the man who follows you, and so on down the centuries until we have become an elder race and no longer need our shield of brains and steel."

"Hi, Brother! You are not alone!"

And so, when the six ships of Patrol Twenty came drifting in to their landing at the Station, the man who waited to greet them had more than the battle star on his chest to show he was a veteran. For he had done more than win a battle. He had found his soul.

THE END

THE ANALYTICAL LABORATORY

Being short of space, we will simply give the report on the November 1951 issue:

Place	*Title*	*Author*	*Points*
1.	The Hunting Season	Frank M. Robinson	1.57
2.	Iceworld (Part 2)	Hal Clement	2.23
3.	Implode and Peddle	H. B. Fyfe	2.71
4.	To Explain Mrs. Thompson	Philip Latham	3.35

THE EDITOR.

EV

BY RAYMOND Z. GALLUN AND JEROME BIXBY

Any astronomer can calculate the Escape Velocity for any planet whose characteristics he knows. But there is another concept of Escape Velocity that can't be calculated—yet.

Hiller had placed the model in a lead-lined cabinet, meant to shield observers from its radiations. It could be watched, however—and was being watched now—through a tiny window of leaded glass.

Its name was Ev. It was a silvery cylinder, clamped to a spidery metal frame that stretched long legs to the

corners of the cabinet; and it looked like a small rocket—which it almost was.

But its fuel was not alcohol and liquid oxygen. Its fuel was a powder, the dust of a metal, heavier than the plutonium or U-235 of the first atom bombs—but, like plutonium, synthetic. The small flame, jabbing down straight as a pencil from a vent at the lower end of the cylinder, glared like a fragment of the sun, and not unnaturally so; for the power of the A-bomb, too violent in that original form to propel anything except itself into Hell, here had been tamed to a stream of tenuous, speeding gases and other fission products that gave a steady thrust.

The room was dark, save for the round bright eye of the window and its enormous, wavering counterpart on the opposite wall; and the latter was abruptly eclipsed as Hiller bent again to the window. He puffed his pipe, which had gone out, his gaunt features seeming to soften even in the harsh light. He loved this thing as a master violinist loves a Stradivarius. He was not its sole inventor, of course—no one could have been in these days when knowledge of physics had become so specialized—but he had done more of the thinking, more of the actual work, than any of the others here in this government laboratory.

Now he stepped aside, motioning the Army man—Hiller had forgotten his name—who had been sent to tentatively verify his report of the success of the project, to look through the window.

The Army man's bulldog face moved into the glare, and Hiller touched a dial on the cabinet's wall. The little flame lengthened, producing thrust just as the exhaust of the simplest skyrocket does—by kick or recoil—but the wreckage of broken atoms, which formed the substance of the flame, was far thinner than the exhaust of a skyrocket, and inconceivably hotter and faster moving.

The jet motor surged upward a few inches, straining at the movable parts of its test frame which were tethered by heavy springs. A meter needle at Hiller's elbow swung from numeral 4 to 7.

"The motor weighs just over three pounds, fuel and all," Hiller said, in the darkness. "Its maximum thrust is seven pounds, which means that it can lift more than twice its own weight, vertically. It can go on doing this without exhausting its energy in a few minutes, as chemical rockets always do. Six ounces of fuel are enough to give it full power for eight hours—"

He spoke rather absently. Though he was a government scientist—whatever that meant—he felt distinctly separate in spirit from the shrewd-faced man, two-thirds his own age, who stood peering into the cabinet. Hiller's work was part of the national defense project; yet by a quirk not uncommon among scientists—government scientists not excepted—he had scarcely thought about weapons of war as he had toiled over the atomic jet motor these past months. His mind had ever been on another objective, beyond the thought of aircraft either military or civil. It was a goal—some called it a dream—that he had reached for during most of his life.

And it was at last within grasp.

Hiller sighed, retreated mentally into the familiar details of his "dream." How much speed could be built up by a motor that gave a thrust more than double its own weight, a motor that carried an eight-hour fuel supply to provide an acceleration that could be constant yet never too great for the human body to endure? The old V-2 rockets, with a comparable thrust-to-weight ratio, had attained a velocity of a mile per second in less than two minutes—but by then their crude chemical fuel was spent, and their speed limit reached.

Ev had no such limitation on fuel; so Ev had no such limit on speed.

What would your velocity be after thirty minutes or an hour of such gradual acceleration? Too much for comfort, if you were moving through air—but if you were traveling where there was no air to retard your flight?

Some called it a dream—

Hiller thought of the so-called canals of Mars, of its dead deserts that could live again, of colonies of Earthmen humming in great plastic domes beneath Phobos and Deimos. He thought of Venus, Jupiter and the other planets, and of the thrilling possibility of contacting an alien culture. And he thought of the concordant Man that must slowly, but very surely, emerge from this great adventure. For with the struggle, the pioneering, a cultural contact—well met or ill—must come a new perspective of Earth, indivisible in its humanity, as one nation among the stars.

The visitor's lips pursed; he bent again into the glare. Perhaps, Hiller thought, he was visualizing the vast speeds, the wide range of action that such a thrust and low fuel load would make possible. Or perhaps he was phrasing the report he would shortly make to his superiors: *Hiller has tipped the scales. There is no longer the question of a balance of military power. We now have reasonable assurance of winning the war. There remains only to allow it to start—*

Hiller snapped on the lights, twisted the dial that brought Ev to rest in its frame. As he puffed his pipe alight, he slowly answered the few questions that were put to him. His visitor and he did have this laconic quality in common, this stinginess with words, this private visualizing.

"Can the radiation shields be made light enough to be carried by planes? Will they be effective enough to protect the crews?"

"I think so," Hiller said. "Most of the radiation will be thrown aft with

the jet exhaust, where it can't harm the crews anyway. And we're working on a new alloy of lead. A single bulkhead of it, between motors and cabin, should absorb or reflect any stray energy—"

He hesitated, then said with no particular inflection, "Apart from military considerations, you know, Ev is the answer to space travel."

"Ev?"

Hiller smiled slightly. "A nickname some of us have given the motor. Short for 'escape velocity.'"

The Army man pursed his lips again; it was apparent that he wished to say nothing, but that he felt Hiller's position warranted a reply of some sort. "Yes," he said at last, "it would seem to be. I wouldn't say, however, that space travel is apart from military considerations—" He stopped; that sort of reply was not indicated.

"Moon bases for guided missiles," Hiller said heavily. "Satellite stations, raining atom bombs. That's about it, eh?"

The Army man gathered up his hat and brief case. "Those seem a little fantastic for the present, Mr. Hiller. But such uses for the motor will no doubt receive attention."

"Do you believe that this motor would win a war," Hiller said, almost gently, "assuming that we found ourselves in one? Granted that Ev could deliver atomic warheads with such complicated evasive action that interception would be impossible, do you honestly believe that, no matter how hard and fast we struck when the lid blew off, we could even begin to escape what would be thrown at *us*? Could anything—anyone—*win* that war?"

The Army man turned to the door. "I have enough information for now. Thank you for your time. An examining board will check over the motor in detail tomorrow. Good night."

"I'm sure they'll be satisfied," said Hiller.

"Do you know," he went on, "why space travel has been impossible until now—and why it *is* possible now?"

The bulldog face didn't smile. "Ev."

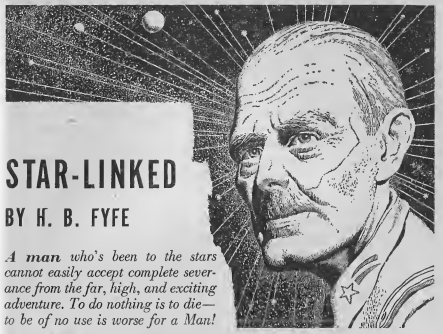
"Test rockets have risen, risen strongly—but have always fallen back to destruction. You know that."

"I know that no motor has been developed that can carry sufficient fuel to enable it to attain escape velocity—until now, of course."

Hiller puffed in and out through his pipe, making little connected mushrooms of smoke that drifted toward the ceiling. "Tell me, sir: Has it ever seemed to you that the civilization of Mankind is a test rocket rising again and again from the level of savagery—yet somehow never able to apply sufficient wisdom to attain escape velocity?"

The Army man put on his hat; it shadowed his eyes and the expression in them. He said tonelessly, "Good night, Mr. Hiller."

THE END



STAR-LINKED

BY H. B. FYFE

A man who's been to the stars cannot easily accept complete severance from the far, high, and exciting adventure. To do nothing is to die—to be of no use is worse for a Man!

Illustrated by van Dongen

The walls of the small communications office seemed to have been erected mainly to hold panels of dials and switches. One end of the cubicle was occupied by the control desk, banked high with rows of toggle switches and push buttons labeled with the names and code numbers of stars or planets at which telebeams might be aimed by automatic mechanisms. There were also more complex controls, for use by the operator in contacting worlds infrequently called from this interstellar station on Phobos.

In the right-hand rear corner was a simpler desk with a microphone and a single telescreen for a stand-by operator. Of the remaining space, the best part was taken up by Harry Redkirk's chrome and leather swivel chair.

"Sorry, Oberhof," Redkirk was saying. "I can't put your man through direct from Luna to Centauri IV. It's behind its sun."

"Any relay possible?" asked the dark-haired man watching him—apparently—from the large screen at Redkirk's eye level beyond the desk.

This screen was flanked by eight smaller ones arranged in vertical pairs and identified by association with the several transmitters of the station. Screens One and Two went with

"Beam A," and so on. At the moment, Six and Eight, to Redkirk's right, were alive with outgoing, previously transcribed, routine messages. The voices, at super speed, were high and gabbling.

"I'll try through one of the Wolf 359 planets," said Redkirk.

He switched on the automatic caller and punched the button that would cause the beam to be aimed at one of Sol's closer neighbors across about eight light-years of space. There was no need to worry about adjusting for the position of any planet not hidden by the star; the best beam achieved by man would spread at that distance to blanket the whole planetary system. Even subspace waves had their limitations, although Redkirk's job was made possible by the fact that their time lag at that distance was imperceptible.

Redkirk's face became intent as the answer bleated in from Wolf 359. He made manually the last fine adjustments to tune out a slight fuzziness left in the signal by the automatic correctors, and looked up at the screen from which he had temporarily displaced the Lunar operator.

He was thin enough to seem tall even while sitting down. The effect was increased by a leanness in his features; he had a long, pointed chin, arched nose, and hollow cheeks. Straight yellow hair was combed back from his high forehead, along the left side of which ran a long, narrow scar. Except for this white mark, his face was tanned to the dusty gold shade often seen in blond people who do not burn red.

Had it not been for the tan, anyone examining him at the moment would have thought him a sick man. The lines from nose to the corners of his mouth were deep grooves. If the wrinkles around his eyes suggested laughter, the frown-creases between them spoke of pain.

Here he comes, thought Redkirk, as he brought into perfect focus on his main screen the image of a nonhuman.

The distant operator was chunky, tentacled, and rounded, with several hooded eyes. Behind him, the scene was flat and shadowless, which in this case meant to Redkirk that it was as dim as might be preferred by beings in the system of an M8 red star.

He keyed off a sequence of universal signals. After a moment, the tentacled one replied with a similar standard message.

"He can get them," Redkirk told the Lunar operator as soon as he got him back on the screen. "Get your party on!"

A few minutes later, he had an Earthman on screen One and another from the Centaurian colonies showing on Two—the beam picked up by his receiver and the one he was transmitting. He listened a while to make sure everything meshed, and caught fragments of a conversation about something or other to be sent back to Sol in the next interstellar ship.

Redkirk flicked a finger at the Lunar man as the latter withdrew from the main screen to attend to other affairs. Then he leaned back in the chrome and leather chair, thinking idly of the years he had spent piloting such ships as the two men were discussing.

Oh, well, he thought, *I had it for a while and I shouldn't gripe at having to stay here spinning around Mars. Many a good man would like nothing better than to have a shift at the main interstellar station of the Solar System.*

Demand for the job did not worry him, however, for he recalled that the company owed it to him for the rest of his life if he chose to keep it.

He had been on the desk about an hour of his four-hour shift, during which the tiny satellite would move around the spaceward side of Mars and back to intersect the orbit ahead of the planet. In another hour, Johnny would come in with coffee, and two hours after that, Garnier would relieve him.

"Not that I'm anxious about it," he murmured. "I'd stay a day at a time, if they'd let me."

He switched the main screen to a view through the exterior scanner and focused in a view of Mars. Half of the mottled red planet showed above the jagged horizon of Phobos. He knew that if he watched the ruddy disk long enough, it would give the impression of rotating backward upon its axis. The speed of the tiny moon was such that it made better than three revolutions in a Martian day. Redkirk manipulated the controls to scan the sky, and other viewers set along a band about the satellite came into action. Against the black void, the stars shone hotly, watching, waiting, drawing his consciousness out of reality toward them.

A series of *beeps* signaled a call from the Lunar station. Redkirk snapped out of his reverie and replied.

"Got a nice one this time," Oberhof told him. "Mr. Secretary Rawlins, of the Solar State Department, wants to talk to Ambassador Morelli."

"All right," said Redkirk agreeably. "Where is he?"

"Only aboard the space liner *Iris*, SL-3-525, which is presumably"—he referred to a note before him—"about three-quarters of the way to Procyon right now."

"Oh, fine!" groaned Redkirk, rolling his eyes upward. "How about sending the message to be recorded on Procyon V and held for Morelli's arrival?"

Oberhof grimaced.

"That's what I said. No go. He wants him in person, so they can use a scrambled signal and exchange dope in private."

Redkirk chuckled.

"How private can you get, shouting for light-years through space in this

day and age? Well, I'll see if I can pick them up."

He switched beam C to the direction of Procyon, expecting little trouble in sweeping the volume of space containing the ship. Unless the latter had moved fantastically off course, the spread of the beam would catch it as well as the planets of Procyon. The trouble was that a moving ship in subspace drive often had difficulty in picking up signals sent after it by a process resembling its own method of propulsion. Any little maladjustment or interference, even a thin cloud of cosmic dust, was enough to prevent reception.

Redkirk set a tape to beeping out a repetitive call signal, and glanced up to meet Oberhof's eye.

"If it doesn't work," he promised, "I'll get Procyon V to tell them to call me."

"Fair enough," said Oberhof. "I'll let you know if His Nibs objects to doing it that way."

"Any time," said Redkirk. "I'll be out of touch with you for a couple of hours soon, but you can pick me up again when we swing around Mars."

The Lunar operator hesitated, and the other saw his shoulder move as if he had dropped his hand from the cut-off switch.

"What kind of shift do you pull?" he asked Redkirk. "I haven't been on the station long enough to know everybody yet."

"About four hours, once in sixteen. Actually, it's figured according to the time it takes Phobos to get around its orbit. Pretty near to what you pull, isn't it?"

"Yeah," said Oberhof, "but I heard that you . . . uh, you used to be a pilot, didn't you?"

Redkirk grinned, and some of the traces of pain disappeared from his thin face.

"You mean you've been hearing stories of how I piled up a Martian liner on the Lake of the Sun?"

Oberhof managed to look polite and curious at the same time.

"Well . . . they say you got it pretty bad, and being it was mechanical failure, you could have a pension."

"So why do I work at Phobos?" finished Redkirk. "But why not? A man's got to do something."

The Lunar operator seemed about to ask further questions, but manners got the better of interest, and he switched off after a few aimless remarks.

Redkirk tried the ship's code signal at intervals, but failed to get an answer.

"They wouldn't leave their receiver off out there," he muttered to himself. "I must be running into some dust or other interference."

He had to put the problem aside when a call boomed up from the surface of Mars. The Solar Exploration Department, in the person of the regional office in Sand City—now beneath the position of Phobos—wanted to contact its current expedition on Pluto.

Redkirk ran his finger down the row of buttons marking beam settings for Solar System bodies, found "Pluto," and put out an automatically aimed call.

Within the planetary system, the possible error due to the mechanism's not precisely matching the motion of the planet was trifling, and he had an answer coming back before he had time to think about any correction.

"Your headquarters on Mars wants to talk," he told the square-faced man who appeared on his main screen.

The latter grimaced slightly, then nodded as if resigned to wasting time that might be better employed in the long overlooked task of studying the frigid planet.

"Put them through," he said. "If they're willing to talk to the assistant chief, I'll try to tell them what they want to hear. Tell them you have Hodges; the boss is out on the ice."

Redkirk checked the Martian operator, and presently had a two-way conversation flowing through Three and Four. Seeing that the relay of the series of routine messages through Six and Eight had been completed, leaving those screens blank, he switched off his C and D beams. Except for a few minutes when he had to arrange film recording of more such messages from some asteroid stations to be retransmitted to Martian townships as Phobos circled into a favorable position for it, he listened in to the beam from Pluto.

The report was weighted with statistics and technical requisitions until the square-faced Hodges withdrew from the screen in order to show his superiors an example of the party's boring toward the planet's surface through ice and frozen gases.

Redkirk followed with eager interest the process of thermite-drilling a well down through strata of congealed substances. The film recording of the first blast revealed an unearthly kaleidoscope of colors on the dark surface of the planet from whose position Sol was merely a bright star. Then, artificial lights showed the spacesuited figures preparing for further penetration. Subsequent scenes displayed samples of the walls as the passage probed downward.

Redkirk was sorry when the directors on Mars were brought up to date with a view of the bottom of the digging. Switching off after the communication had been completed, he realized that for a quarter of an hour he had forgotten where he was.

"Comfortable little hole, though," he murmured, gazing about at his eight-by-ten office. "Lot warmer than Pluto."

The quiet sough of the air-conditioning unit had heightened his imagination of nonexistent, freezing blasts of wind whipping across the chill waste on the screen. He decided he

was just as happy to hear Johnny clattering coffee cups in the outer office.

A moment later, his young assistant thrust his head inside.

"Got time for coffee, Harry?" he asked.

"Fill 'er up!" called Redkirk. "I've just been talking to Pluto, and I need something to warm my bones."

Johnny brought in the coffee and sat with his on the corner of the stand-by desk after handing Redkirk a full cup.

"Much doing?" he asked.

"Nothing special," answered his chief. "Except one for a spaceship almost to Procyon. I can't pick them up."

He thought a moment, savoring the hot liquid.

"Johnny," he directed, "look up the *Iris* in the Solarian Register, and see if her code signal is really . . . uh . . . SL-3-525. Maybe Luna didn't have it right."

The youth took down a volume from the shelf of such reference books and leafed through it, holding his coffee cup in one hand. When he found the ship on the list, the call signal was correct.

"Then I'm just not hitting her," said Redkirk. "Luna won't be on our necks for a while, till we come out from behind Mars, but I'd like to have something to tell Oberhof by then."

"Why don't you relay through some Procyon planet?"

"Oh, there's some big jet on our end. Oberhof thinks it's diplomatic and secret."

He frowned over the problem until Johnny went out to refill their cups. Deciding that he would contact Procyon only as a last resort, Redkirk pressed the button that would aim his A beam at Pluto.

"Could you do me a little favor?" he greeted the square-faced Hodges when the latter appeared.

"Sure," said the explorer woodenly. "Want me to run down to the corner for a beer or a blonde?"

Redkirk repressed a grin, realizing vaguely what a lonely life the other was leading at the moment, and explained his situation.

"Either they're not able to pick up my signal," he concluded, "or something is screening me out. Remember last month when you had trouble getting Phobos because a flock of asteroids distorted your beam?"

"Well, I'll see what I can do," promised Hodges. "Don't forget—I haven't the power you have at that big station."

"If you can just get them to call me," said Redkirk, "it will tell what the score is."

The man on Pluto nodded and faded out. Five or ten minutes went by before he reappeared. His broad face showed a trace of excitement.

"By golly, I picked up a weak answer!" he exclaimed. "I can just about focus a blurry image. What do you want me to tell them?"

"Have them give me a call," directed Redkirk.

He waited, scanning the instruments that would report any reception too faint to appear as sound or picture. One needle, after a while, wavered reluctantly. That was all.

He adjusted the same antenna for Pluto, as a check, and Hodges came in clear and strong.

"I can't pick them up," said Redkirk. "Now, listen, and tell me if you can do this—call the Lunar station and let them know you have the *Iris*. Then relay if they can't catch her signal. I'm out of it both ways, at least till Phobos swings further around Mars."

He sat back after Hodges had faded out, grinning at the feeling of having pulled strings all around the System. He doubted that Oberhof could pick up the ship's beam; whatever was damping it before it reached Phobos would probably take care of Earth also.

In a few minutes, he discovered that he was not entirely cut off from the operation. Hodges worked manfully to feed the images through Pluto to Luna at one end and the *Iris* at the other, and Redkirk's receiver picked up the beam relayed inward from the frigid planet.

Ambassador Morelli was a blurry white face with dark blurs for eyes and black hair. Evidently, however, he was recognizable to his superior, for the conversation continued quite a while.

"Wish I could figure out what he's talking about," murmured the Phobos operator.

Morelli, in stilted, guarded phrases which he chose like a man selecting a life insurance policy, indicated where the "information" desired might be found. That is, he seemed to be naming a place—Redkirk did not believe the Department could employ so many people with such curious cognomens.

Well, if it is a code, it's probably none of my business, he thought regretfully.

He decided that he was getting to be a busybody, and was relieved when the time came to send some of the transcribed messages down to the Martian cities. This kept him intermittently busy for some time.

Shortly after the last message was cleared, a call came across the System from Venus. Someone had to speak to Altair VII about certain Altairian microorganisms desired for urgent medical research. Since it turned out to be a conference hookup with several personages at the terminal screens, Redkirk and the Altairian operator kept in constant contact on a companion beam to monitor the transmission.

The Altairian struck Redkirk as being oddly human in movements and bodily attitudes despite a strikingly

unhuman physique. There was no actual separation of head from body, and the numerous short, one-sectioned arms ending in powerful claws suggested that the distant being had evolved from something that had crawled. His skin gleamed, between areas of warty protuberances, with brown and golden tints reminiscent of either polished leather or some metallic substance.

"Do you happen to speak Solarian?" Redkirk asked him, having glanced again at the beams focused on screens One and Two.

"Some."

The answering voice boomed slightly, and Redkirk realized that it was produced by the vibrating membranes of air sacs that swelled out below the wide, blubbery jaws.

"I have never been to Altair in person," said the Earthman. "Would you have time to show me an outside view near your station?"

"What . . . purpose?"

"Just curiosity," Redkirk told him. "I want to see what things look like in the light of a white, Class A star. Sol is G, you know, and yellow."

"Last part slow again?"

Redkirk repeated.

"I'll show you scenes of Solarian planets, if you like," he offered in conclusion.

"Would like," the Altairian assured him.

He faded from the screen and Redkirk took the opportunity to consult his list of filed films for what he needed. While searching for scenes of Mars and Earth, he had the outside scanner pick up the part of the crescent of Mars that showed above the jagged horizon of Phobos, and sent it out through screen Four.

He chose a few representative scenes of Martian deserts and of mountains, oceans, and cities of Earth, and fed them into the series as he watched what the other operator sent back—stealing a second here and there to check on the main business going through.

Even with reception automatically adapted to human vision, the landscape of Altair seemed bright and shadowless. The glare of the white star burned down upon great expanses of flat land covered by low-growing shrubs with pale, fleshy leaves. In the distance, several mountain peaks glittered, some of them smoking with evidence of volcanic action.

Even an ocean scene made Redkirk feel hot, as if he were exposed to the glare of Earthly tropics. He decided that there was good reason for the Altairians he saw swimming to sport such heavy hides.

The distant operator had just switched in a view of one of his system's satellites, not unlike the scarred face of Luna, when the conference broke up.

Redkirk hastily brought the private showing to an end. Before switching off, he thanked the Altairian.

"Most pleasure," the other assured him in drumming tones. "If call again, ask for Delki Loori-Kam-Dul."

"Thank you, I will. I am Redkirk . . . Red-kirk . . . yes, that's right."

He punched a button to record the number of the station's film copy of the transmission for the commercial department or other future reference, and cut the beam. He also made a mental note of a new acquaintance, sixteen light-years away in the constellation Aquila.

He leaned back in his swivel chair for a few moments, thinking about the harsh surface of the planet he had just seen. He was aroused from this reverie when a call beeped in from Luna.

"Say! I've been waiting to come in line with you again," he greeted Oberhof. "I wanted to ask you about that message."

"The one to the *Iris*? You wouldn't want me to give away diplomatic secrets, would you?"

Redkirk's eyebrows went up.

"Was it *that* hush-hush?" he demanded, incredulously.

Oberhof put on a knowing expression and shifted his ground.

"Later, if I think I'm not being spied on," he muttered. "Right now, I think you better take this call."

"Who's it for?" asked Redkirk.

"A personal for you," replied the Lunar operator. "From a . . . uh . . . Mrs. Nina Redkirk, of Earth. There's also a film. Shall I send that on my B band while you talk?"

"Shoot!" said Redkirk.

He cut in his recorder via screen Five, then leaned back to take the personal on his main screen. In a moment, the features of a young woman with reddish hair and a pert nose came in clearly.

"Hello, Nina," said Redkirk.

She smiled, a shade too cheerfully, for he could see concern in her eyes.

"Harry! It's good to see you! How is everything?"

"Same as ever," he answered easily. "You know by now what it's like at a station like Phobos. Tell me about you—that's what I'm interested in."

"Oh . . . you know . . . gosh, it's funny how I can make a call like this and then forget everything I was going to say! Did the man on Luna tell you I'm sending movies I took of Barry?"

"I'm recording them right now. That Oberhof isn't one to waste time. How about Eric Barrow? Still seeing a lot of you?"

"Ye-es." She looked down. "As a matter of fact, that was one reason I wanted to call you."

"Going to marry him?"

Her head jerked up at that. She searched his face for a clue to his feelings. Though Redkirk could not see her hands, he suspected that they were twisting at her handkerchief, or gripping tightly on a pencil.

"If you don't," he added good-naturedly, "you're a fool. I get reports

that he's a pretty nice guy."

"Reports?"

He waved one hand airily.

"Oh, I've built up a lot of connections in this job. You'd be surprised at the places I can reach to for answers."

She smiled ruefully.

"Then you don't care too much? Honestly?"

"Of course not! We had a good life together for a few years, and I'm grateful to you for it; but I have a place here that I'll probably keep for life. That's why I insisted that you get the divorce. No use in your living like a widow with none of the advantages of that state."

She had to laugh at the wicked wink he sent across space to her. Then they talked of a few other matters—Barry's schooling, the new puppy, and the like.

"We'll have to cut this," said Redkirk. "I'm getting a signal. Now, don't forget to call me every so often. Tell me about the wedding. And keep those movies of Barry coming; they're swell!"

Nina said good-by hurriedly, and Redkirk cut the screen. He glanced at Five, saw that the film had been recorded, and keyed off a routine acknowledgment to Luna. Receiving no return call, he assumed that Oberhof was busy.

He had had no incoming signal, but the sight of Nina had made him wonder how long he could keep up the pretense of gaiety. Earth suddenly seemed so far away that he could hardly believe he had been born there.

A real signal made his head snap up. He realized that he had been sitting there staring sightlessly at the controls for several minutes. He brought the call to the main screen and discovered that it was a simple relay from Canalopolis on the red planet inward to Earth.

Oberhof showed his face briefly during the operation.

"I'll call you back in a little while," he told Redkirk.

The latter pressed a button that would remove the record of Nina's film from the file and focus the pictures on his screen. He grinned faintly as he saw Barry romping with a gangling puppy on a lawn of green Earth grass, and felt a pang of loneliness as his six-year-old son sawed off the first slice of a large birthday cake.

When the film had run off, he sat quietly for some minutes before Oberhof's signal came in.

Redkirk shook himself and answered.

"Now zero-beat that rasping voice of yours and say something!" he ordered Oberhof. "What was the big rumpus?"

The other operator grinned and wagged his head.

"Don't know as I ought to tell you. Top secret. A real emergency call out to the depths of space!"

"Come *on!*" demanded Redkirk.

"Well, to give you a quick schematic—Morelli lit off for Procyon without turning in the combination to his office wall safe. Left it with his wife and forgot to tell her it had to be taken in to the department instanter."

"Yeah—?"

"That's all."

"No secret papers? No urgent instructions?"

Oberhof sucked in his lower lip and shrugged.

Redkirk looked around at his communications office, at the dials and switches and instruments. He thought of the powerful generators outside, of the delicate and marvelous mechanisms that could direct a beam across light-years of subspace.

"Might have known," he murmured. "If Earth were exploding, they'd have put through the message by routine recording."

"I would like to send him a personal bill for the complete cost of that little chat," growled Oberhof.

"Take it easy," said Redkirk, grinning. "Maybe we'll save the world *next* time."

He glanced over his shoulder as the door opened.

"Watch that blood pressure," he advised. "I'll have to cut off now; here comes my relief."

Oberhof waggled a finger at him and faded out. Redkirk looked over his shoulder.

"Ready, Harry?" asked chubby Ed Garnier from the doorway.

"As good a time as any," agreed Redkirk. "Everything looks quiet for a few minutes. Johnny out there?"

"Yeah. We'll be right in."

Redkirk ran an eye over his board. The screens were dead and all his traffic for the watch had been cleared. He pulled out the operator's log and signed it after glancing at the time.

Then he heard Johnny and Garnier coming in, and turned his head to watch them maneuvering the wheelchair through the door.

Redkirk put one hand against the edge of the control desk and swiveled himself around as Garnier pushed the

conveyance over to him. Johnny prepared to help him from one chair to the other.

"Dunno how you do it," remarked Garnier, steadying the wheel-chair with a broad-fingered hand as he watched Johnny lift his chief effortlessly in the light gravity of Phobos. "Honest, I don't. After a crack-up like that, I think I'd crawl away an' let somebody take care of me the rest of my life."

Redkirk got his hands on the grips of the wheels and pivoted to face Garnier. He looked up at the relief operator with a grin on his lean, tanned face.

"Stop making me a hero!" he jeered. "What would I do in a hospital on Mars or Earth? Anywhere but Phobos, I'd be flat on my back and helpless."

To demonstrate his present mobility, he rolled around Garnier and pivoted the chair in the doorway to look back at them. In the outer office, Joe Wong, Garnier's stand-by, clinked a cup as he poured himself coffee.

"How was that?" Redkirk asked Garnier. "The way I'm banged up, it's only in gravity like this that I can get around at all."

Garnier nodded sympathetically.

"Yeah, I don't blame you," he said. "A guy could go crazy, I guess, just lying in a bed and thinking about how he could never pilot a ship again, never even go any place. Of course, he *could* see his wife and family and friends, instead of being marooned on a chunk of rock like this."

Redkirk smiled at him.

"I don't feel very marooned," he retorted. "Tonight, for instance, I talked to a man on the moon, watched a test digging being started on Pluto, and arranged a little matter with a stranger on a Wolf 359 planet."

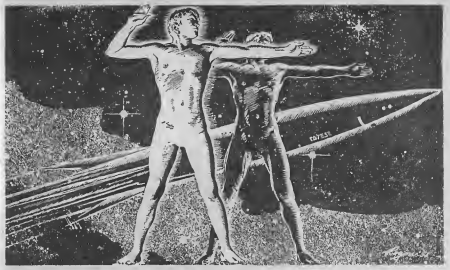
Behind Garnier's back, Johnny glanced at the log.

"I also listened to a Solarian ambassador speaking out of space just as if I were at the controls of another ship again," Redkirk continued. "Then I got me a good look at a planet of Altair that I never saw before. And to top it off, my best girl called me long-distance and I watched my boy grow a year!"

Garnier hitched up his jaw. He and Johnny stared briefly at each other, then back at Redkirk.

"And you call it *work*?" laughed Redkirk, backing out the door.

THE END



INFORMATION

BY ALAN BARCLAY

***It would** be such an exceedingly uncomfortable feeling for a general to launch an attack—if he knew his proposed victim had a really effective weapon of reply! Like being* there *without being anywhere in between to permit interception!*

Illustrated by Rogers

Things run in families, as the saying is. Things such as a talent for music, or for mathematics, or for piloting spaceships—or for having twins.

Rik Cantlan's family had always exhibited a marked talent for steering things. A remote ancestor of Rik's had landed the first ship on Venus about a month after experts had proved this to be a practical impossibility. Grandpa Cantlan in the days of his youth had once steered a thing he called a crawler—a contraption weighing about ten tons mounted on caterpillar tracks eight feet wide—up a flight of marble steps and into the middle of about an acre of red plush carpet adorning the floor of his Group Headquarters Mess.

He was drunk at the time.

Rik's father flew one of these odd-looking winged atmospheric craft they go in for on Ardan Minor underneath a bridge. Later, during the recent war, he flew a single-seater chaser right slap through the flagship of the enemy space navy. Admittedly this performance killed him dead, but it did the same thing to the flagship and to large numbers of big brass and other important personalities who were inhabiting it at the time. Rik inherited the family talent. He was test pilot at the Space Flight Research Center, with the rank of Lieutenant, Junior Grade, Argol 11 Space Navy.

Here is Rik, reporting to his C.O. He is precisely two thousand feet up, in the dead center of the traffic lane heading for the Center. He is doing five hundred m.p.h. He is not doing any more than that because his flivver, which is his own private flivver and not by any means new, will not go any faster.

A few moments after first meeting him, you find him in a stationary position, poised above the parking space adjoining the Center's Administration Building. He is still at two thousand feet, for traffic regulations insist upon a horizontal approach followed by perfectly vertical descent. Some people come down slow into car parks. Others like to come down a bit faster than that. Rik's method consisted of cutting his lift and letting himself drop like a stone, then checking his fall at the last possible moment.

"You were less than three inches off the ground when you stopped her that time, Mr. Cantlan," one of the garage hands protested. "One of these days you'll let your foot slip and you'll stop so near the ground you'll make a deep hole."

"I expect I'd just bounce about six feet," Rik told him. He made for the Administration Building, and for the C.O.'s office. After a suitable delay—there never was a time when Lieutenants, Junior Grade, could walk straight into their C.O.'s office—he was admitted to see the great man.

"Ah! Cantlan," said the great man. "For the record I'm supposed to have fetched you here to give you a wigging about something or other. Can you think what that might be? Have you been indulging in any forms of vice lately?"

"None, sir. That is to say, no breaches of Service discipline or even of civilian traffic regulations just lately, sir."

"Ah, well! Consider you've been lectured. Consider yourself reprimanded. Now let's get on to the real business—"

"What are you going to call me this time—just for the record?"

"Let me see . . . shall we say 'insufferable young puppy'?"

"You've used that one twice already, sir."

"Then invent something better if you can. Now, business. How's the Professor coming along with his work, do you think?"

"Just as you have always expected, sir. He'll get the answer sometime, sure enough, but not soon. Maybe in five years, maybe ten. Of course, he thinks he's pretty well got it already, but you know how he talks."

"I'm more than ever convinced it will take some years," the C.O. said. "I've read his latest report . . . when I say 'read it', I don't mean understood it, except that what he is saying is No. Not yet."

The C.O. stopped, and looked Rik straight in the eye.

"We now know for sure that Corrul will be lined up to make their attack on us in six months from today. If we had our ships fitted with this new drive, and if they *knew* about it, we're convinced they would think twice."

"Yes, sir," said Rik.

"So now is the time to consider putting your own scheme into operation. Sit down, Rik. Let us discuss."

They discussed, for nearly two hours.

Meet Jarvan Algar. Middle-aged, tall, spare, gray-haired, handsome, amiable, popular, wealthy, manager of the Corrullian Export-Import Agency on Argol 11. He had been on Argol for five years; his speech was quite free of that irritating affected Corrul lisp. He was well-liked by every kind of person on Argol. In addition to being manager of the Corrullian Agency, a fact which was known to all, he was director of Corrul's Intelligence in this sphere, a fact which he sometimes—but not always—believed was unknown to anyone.

Meet him in his large pleasant office. He is talking to Sim Pardo, one of his lieutenants. To be precise, he is not talking. He is listening and Sim is talking.

". . . There are quite a number of scientists and technicians allocated to this project, and in addition they have a certain Lieutenant Rik Cantlan, a Service test pilot. He's a typically reckless brainless young man—"

"Spare me the character sketches, Sim, my dear fellow," Algar interrupted amiably. "I know Rik Cantlan. Brainless or not, he is a top-rank test pilot, and if he's in this thing, it's important. Now just try to tell me, in less than fifty thousand words if you can, what they're trying to do."

His amiability appeared to have the effect of making Sim nervous.

"Yes, sir," Sim said. "They're working on an application of the Darlan Hyper space warp principle—"

"Ah!" Algar interrupted, and reached for a drawer. "I had some suspicion of this. I've had some notes on the subject sent out. There are definite possibilities in this principle—Here we are: investigated mathematically by Darlan about fifty years ago—quite interesting—quite promising. Just one snag, and do you know what

that is? No, I'm sure you don't. A space warp of this sort *can* be produced; it *can* be made to envelop a physical object, even a large one; it *can* be caused to transport that object. But there is *no* means—I repeat, *no* means at all, of pre-selecting the point in space at which the object will be released from the warp. In other words, once a spaceship, for example, is enveloped in the warp, it might be released just anywhere—"

"So the local boys are just wasting their time?" Sim concluded triumphantly.

"You're a fool, Sim," his boss told him imperturbably. "Don't you know that inevitably, as soon as one scientist has proved a thing to be impossible, or impracticable, or unmanageable, another scientist starts sitting up nights trying to prove him wrong—and generally does. Who've they got as their top scientist?"

"The well-known nut Torkin. Calls himself 'Professor', quite like old style." Sim spoke scornfully. "They dug him out of one of the local loonybins, where he's been under care for the last five years. He's incurably homicidal. He knocked off one of his technicians once with a laboratory stool. Now they've let him out and put him in charge of this cockeyed project. Of course, come to think of it, he isn't really a whole lot crazier than the rest of these guys."

"Sim, my dear fellow," Algar replied, coldly this time, "I feel you've got one or two wrong ideas on this thing. Listen: Cantlan may, as you say, be reckless and brainless, but as a test pilot he's about the best there is. Torkin is a nut, I admit, but his occasional urges to brain his associates with blunt instruments have nothing at all to do with the quality of the work he used to do on space warps. It was brilliant.

"Consider, my dear Sim, consider this further point: This planet is ripe for the picking. We propose to take it over in about six months from now . . . that is to say, we'll take it over if it can be done quickly and cheaply. We must above all avoid a long and costly war. Suppose after we have committed ourselves to an invasion we discover these people have a new weapon; a space warp, for example, which will take their ships across to Corrul in a few hours or minutes, instead of weeks . . . imagine an Argol warship materializing one day unexpectedly, undetectably, *inside* our defenses, releasing its torpedoes, and then vanishing. Not a nice idea, eh? We want to know if such a thing is likely to happen, eh? Now get out of here and bring me in some news."

"What have you got there, Professor?" Rik asked. "Looks to me like a new super type of radar-controlled remote-acting, self-loading mousetrap."

"You brainless young fool," the old man snarled at him, "must I talk to things like you? I suppose I must,

otherwise I get no co-operation. This is what is called commonly a material object, although the word is meaningless to the modern scientist. To be precise, it's a sphere of heavy metal about one centimeter in diameter. The cage containing it, and the other little et ceteras, are a space-warp generator and director—"

"Ah!" exclaimed Rik. "Director, eh? That's the word that strikes my ear—so you can direct as well as warp? Better than your last attempt, eh, Professor?"

The old man snarled. Saliva dribbled from a corner of his mouth.

"You . . . you—I can direct it and on this occasion I shall even indicate in advance the spot to which I shall shift it. Look, I shall make it materialize within this chalk mark."

"Go ahead, Professor," Rik invited.

"Who reported this?" Algar asked Sim.

"The head laboratory technician," Sim answered. "It was a spherical piece of metal, held in a sort of cage—"

"Any power source?"

"Just a charged capacitor."

"Well?"

"It moves a distance of five yards, into the middle of a chalked ring already marked out by Torkin."

"It was actually seen to move—or did it disappear and then reappear?"

"Can't say, sir—the laboratory man was not able to watch uninterruptedly. The move occurred during an instant when he was looking in another direction."

"What did Cantlan say about this?"

"Made some sort of witty remark that nearly caused the Professor to brain him with an iron bar—something about 'good for mice but not for men.'"

"The Professor made some miscalculation," Rik explained to the C.O. "He's always over-optimistic—the specimen did not move in any direction, right or wrong, when he tried the effect."

"But his report says it did move."

"I know—that was arranged for the benefit of any interested watcher. There were five people in the laboratory at the time. Myself, I am inclined to suspect the chief laboratory basher; he has such a saintly and self-satisfied air. I should be sorry if it turned out to be that rather attractive job of work the Professor has as his secretary. Anyway, whoever was watching, wanting to see the thing move, saw just that."

"But how?"

"The mark of genius is extreme simplicity," Rik informed his superior calmly. "I flipped it across the table with my finger while everyone was being fascinated by the Professor's antics."

"I don't feel that that necessarily puts us a whole lot forward," the C.O. objected. "However, carry on as you

think best. Now, by the way, I've had a Security Report on you, young man. I'm told you're keeping bad company. One Sim Pardo—well known to be in enemy pay—who hopes to get the directorship of some trading concern when we have been liberated. You've been seen weeping in each other's drinks in the Old Sol Tavern, which is a nice homely sort of name for a pretty disreputable dump."

"Yes, sir. Sorry, sir—"

"I hope you know what you're doing?"

"I do, sir. Trying my best to see that we're not liberated. You've no conception how unwilling I am to be liberated."

"Well, if you can drink the way your father did, I suppose I need not worry."

"You needn't worry, sir . . . and by the way, sir?"

"Well?"

"These reports and calculations of the Professor's—does anyone else get them?"

The C.O. looked up at Cantlan from under shaggy gray eyebrows.

"Don't worry about me, Rik, my boy. I'm really quite good at this—I have a team of physicists separating the wheat of genius from the chaff of sheer lunacy."

Sim reporting to Algar.

"They're all set to try a bigger experiment, sir," he explained eagerly. "A sizable chunk of metal, weighing about a hundred kilos—they're going to warp it across a distance of fifty yards—everything is set up. Laboratory cleared. Two sort of metal bulges are fitted one on either side of this test piece—a chalk mark on a bench about fifty yards away to indicate where the piece must land."

"You don't mean to say your man can walk in and out of the laboratory as he likes when an experiment of this sort is going on?"

"Oh, no. The laboratory's sealed now. Out of bounds. No one allowed in, even for cleaning up — but our chap's got a place on the roof of the next building, and a telescope, and a little mirror fixed. He can see everything that happens."

"Well, this time I want him to see the thing actually happen, even if he has to keep watching till he goes cross-eyed."

"Yes, sir. Another thing, sir?"

"Well?"

"This test pilot, Rik Cantlan — he and I are pretty good friends now. He goes most nights to the Old Sol night club—drinks a lot for a test pilot —I reckon it won't be long now before I get him talking."

"Good, Sim. Just be careful, though, that he doesn't get you talking too much instead."

Sim to Algar, excitedly:

"It worked, sir. The experiment worked! Our man saw the test cube shifted. It disappeared off one test bench and reappeared on the other fifty yards away. Just sort of flicked across, as it were. And then they flicked it back again."

"Very well, Sim. Good for you—I won't say it looks too good for Corrul, though. But after all, we're paid to get information. But speak on, my dear fellow, I see you have more to tell."

"Boss," Sim burst out, "I've got the goods. I can show you how the space warp business can be worked—I don't understand these things myself, but I got Rik Cantlan good and plastered last night, and he made a drawing. I kept on ragging him about working on a pipedream experiment under a lunatic scientist. At last he said it was no pipe-dream. It worked. At first he mumbled a bit, talked about it being done by mirrors or something. Finally, when I got him good and sore, he began to draw it out — here it is."

"If this wasn't just too good to be true, Sim, I'd say you'd made both our fortunes—but I'm inclined to doubt whether even Rik Cantlan could draw it on a menu card. I also doubt very much whether Rik would give anything away even when plastered."

"Rik," said the C.O., "you're in trouble. Real trouble this time. Our Intelligence say you were plastered last night in that place of yours and spilled a lot of information to Sim Pardo. You made a drawing, too. What have you to say about this?"

"Sir," Rik answered, "I was not plastered, although a number of people including Sim, thought I was. He had already got a lot of dope on our recent test. Made out that the news of it was nothing more than common gossip. He told me straight out that the Professor had moved a block of metal about fifty yards. 'Come on,' says Sim, 'tell us how you did it, Rik.' So I made a drawing showing that it was all done by mirrors."

"You're a fool, Sim," Algar said. "This drawing, underneath all the wiring and nonsense, is in fact a method of making the trick appear to work by means of mirror reflections and lights. Rik Cantlan wasn't as drunk as you thought. In fact, he probably wasn't as drunk as you were.

"At the same time," Algar continued reflectively, "this does tell us something—quite a few things, in fact. For instance, that they know you're watching. That means they're watching us—hence they have some reason for watching us. Hence again, they must have something real, a genuine secret that needs guarding. Keep after it, Sim, but leave Rik Cantlan alone in future."

"So the drawing showed the old mirror trick, eh?" the C.O. queried. "And how did the shift actually take place? Has old Torkin actually got something at last?"

"I'm afraid not, sir—one of my men and I got in and fixed things up at night. The trick was done with four mirrors and some lights. When the Professor pressed his switches they operated my lights as well as his own gadgets. His gadgets didn't do anything worth while, but my lights and mirrors did."

"What? Then you went and told the enemy precisely the truth?"

"Yes, sir—I told them the one thing in the world they will never on any account believe."

"I see that. It's subtle, though, Rik, quite subtle. It's like fighting an enemy with spiders' webs."

"Our other defenses are not very much more effective against Corrul than spiders' webs," Rik retorted.

"True. Well, what next?"

"Nothing, for a while, sir, than I hope to stage the big thing—the final test. It'll be in a couple of months now."

"Very well."

"In connection with that, sir, how are your tame physicists making out with the Professor's calculations?"

"Having the time of their lives—interesting, they say. Illuminating—elegant treatment—You know the stuff—but nothing solid has emerged."

"What do you know, Sim?" Algar asked his lieutenant some weeks later.

"Nothing fresh, sir."

"Ever heard of blisters, Sim?" the boss asked.

"Blisters, sir? What d'you mean, blisters?"

"They're appearing on all naval ships. Each and every ship has a little trip out to the Satellite. It stays there about ten days and when it comes back it has a neat little pair of bulges or blisters, one on each side just forward of the center section—Why, Sim? Why? Can you tell me that?"

"I don't know, sir. Why is it?"

"You blistering fool," Algar said, appropriately but viciously. "I'm not starting a guessing game with you. When I tell you about these blisters, it means I want you to go out and get me an explanation."

"We could never get a man out to Satellite, sir; it's naval," Sim protested.

"I don't want to hear about your troubles—I'm asking you a question, and I want you to come back with the answer. I want you to come *running* back with the answer. And while you're seeking an answer to that particular question, here are some more to occupy you and your men at the same time: All the factories on this planet are working overtime on naval contracts. Contracts for electronic equipment. For example, large-size tank capacitors—Tell me what all this is about. Get me drawings. Get me photographs, analyses, specifications, all the usual stuff. This affair is beginning suddenly to be a bit too big and fast-moving for my liking."

About two weeks after this Rik

Cantlan was cashiered. There was no doubt at all about this. An announcement appeared in the *Naval Gazette*. Rik himself admitted it. He was to be found, wearing civilian attire, in one or the other of the less reputable bars in the capital, drinking himself stupid. He was quite willing to talk about his troubles. He attributed his trouble to the jealousy of a superior. After some time, no doubt when his money was exhausted, Rik drifted away, disappeared and was seen no more. No doubt he had shipped out to a distant planet.

"What was the specific cause?" Algar asked.

"Eh?" Sim exclaimed. "Oh, you mean what did he do to get himself trimmed. He flew a flivver in at the front door of the Old Sol and went a number of times round the ballroom at an altitude of six inches and a speed of about a hundred and twenty an hour. It was some sight. I was there. He wasn't *in* the flivver at the time either—he was riding astride. You know—it's been done sometimes at exhibitions."

"I know, but not inside ballrooms. Was that all?"

"Not quite. You know there's a pool and a fountain in the middle of the ballroom of the Old Sol?"

"I've been occasionally in the Old Sol," Algar admitted.

"Rik parked his flivver, *sploshl* in the middle of the pool, then undressed, pretended to dive off and swim ashore—"

"I get the general picture," Algar admitted. "Still—"

"Yes, sir?"

"Junior Naval Officers have done tricks like that before—I don't mean that particular stunt, of course, for no other man drunk or sober has the skill to equal Rik there—but naval men do such things, don't they? They're not cashiered as a rule. Reprimanded perhaps, or reduced in seniority. Things are usually said about high spirits, and so forth—"

"Cantlan was given the dull thud all right," Sim asserted with satisfaction.

"I know," Algar reflected. "A bit drastic though."

"Perhaps this is the answer, sir," Sim told Algar a couple of days later. He held out to his boss a printed news sheet. It wasn't in local type; in fact, it was written in the rather archaic script of the remote little planet Epsilon 111 Beta. Algar could read the stuff all right.

"Well! Well! Well!" he exclaimed. "So Rik Cantlan makes a hobby of flying flivvers round ballrooms wherever his ship may land him!"

"Yes, sir," Sim agreed, "he told me his ship visited Epsilon—I guess he did the stunt there first. You see it caused quite a stir. Rik himself spent the night in the local jail. His skipper had to apologize to the local authorities. Then on top of that Rik comes

back here, goes to the Old Sol, gets plastered, and pulls the very same stunt again just to show he can do it twice."

"I guess that explains the severity of his sentence—" Algar's voice trailed away to nothing. He went on reading the paper.

"By the way," he asked presently, "when did Rik pull this trick of his at the Old Sol?"

"The day after he got back from this trip."

"What day was that?"

"Two-hundred-and-tenth of the year," Sim said.

"This paper says the same trick was performed on Epsilon, which, mind you, is some considerable distance away, on the third of their tenth month—just look up that conversion calendar and tell me what Epsilon's third of tenth means in our year here on Argol."

Sim did as he was told.

"Third of the tenth on Epsilon is two hundred and eight of the year here— There must be a mistake. It just can't be right. He does his stunt on Epsilon, and then two days later does the same thing here— Why, it takes sixteen days from Epsilon!"

"Yes," Algar agreed, "it's a mistake—or alternatively it's the answer to our question. Listen, Sim. Get a description of the ship Rik was serving in. Its name, its dimensions. Its captain and crew; their names and their descriptions. Everything about them. Ask if the ship had blisters. Above all, verify the dates. Then take one of the company's ships and send a man to get the same information about the same ship and crew when it was at Epsilon. We must see if they check."

Everything did, in fact, check perfectly. The description of Rik sent from Epsilon was particularly detailed, for the local police had entertained him for a night, and had given him a routine going-over. They even had the mole under his right arm. Besides, there really was no doubt at all. No other man could have done that trick with the flivver without wrapping it and himself round one of the pillars of the dance hall.

"Well," Algar said, speaking to himself this time, "now we know. They take two days to come from Epsilon to Argol. The ship has blisters. A good part of those two days could have been occupied in take-off and approach . . . so there will be no invasion of Argol, not for a few years yet anyway."

He began to consider the form of the report that he must send home.

The C.O. climbed rather stiffly into his official flivver.

"O.K." he told the naval driver. The little machine shot aloft. "Not so fast, young fella-me-lad," the C.O. growled. "Some interested party seeing you toss this flivver around might be reminded of the recently departed Rik Cantlan."

"What's the news?" the driver asked.

"It has worked, my boy," the old man chuckled. "Algar sent off his report. We've seen that. He's had his reply back. They've canceled their invasion plans. Our men on Corrul have positive evidence of this."

"So how long must I stay this way?" the driver asked.

"Until our lunatic scientist and my boys have got the bugs out of this invention."

"That means five years," the driver grumbled.

The development job took four years. At the end of that time the Argol space fleet was completely equipped with the Darlan-Torkin drive. At just about the same time Rik Cantlan was reinstated in his rank, and decorated. A little later than that, Algar received a summons to report home to Corrul. He knew well enough that if he obeyed that summons he would be executed, so he surrendered instead, rather gracefully, to the Argol authorities.

By this time Algar had pieced together most of the true story. Ships can be duplicated. They can even be named alike. Captains and crew can be given duplicate names; even their appearances can be faked near enough to pass for purposes of description, but what Algar never understood, for the secret was never released, was how not only the unique flying skill, but the detailed physical appearance of Rik Cantlan, could be duplicated.

I told you, didn't I, that things run in families? Like skill in music, or left-handedness, or large feet—or even having twins?

THE END

IN TIMES TO COME

In the March issue, a new serial starts; "Gunner Cade," by Cyril Judd — who is an author with four arms and two heads, and uses all with excellent effect — and it has a cover by a new artist, Pawelka. Gunner Cade is the story of a lone, idealistic man's fight against injustice; his right to be a member of his own strange society. They insisted he was a rebel, a villain, an outlaw, and a blackguard. It is very dangerous for a culture to call highly idealistic men such names — which fact Gunner Cade and his civilization found out to their deep, mutual surprise.

Incidentally, that cover Pawelka did — and the black and whites — are his first art work for us. I think we have a new art find. Let me know what you think, will you?

THE EDITOR

THE REFERENCE LIBRARY

BY P. SCHUYLER MILLER

WHAT'S NEW?

The overwhelming trend in science-fiction book publishing has been, until recently, to reprint the best and most popular serials and short stories from the leading magazines. This gives permanence to the best—and much of the second-best—in the magazines, but does not contribute much to the development of types of science fiction which do not fit the editorial policies of the existing periodicals.

As was noted last month, seven "new" science-fiction novels appeared during the first nine months of 1951 which had not been serialized previously. Except for minor adjustments to provide the necessary installment-by-installment suspense, it is a little hard to see why such stories as Williamson's "Dragon's Island," Campbell's "The Moon is Hell," Temple's "Four-Sided Triangle," or Mullen's "Kinsmen of the Dragon" would not be very acceptable to the editors and readers of most magazines now or recently in the field. But L. Sprague de Camp's "Rogue Queen" is something else again.

Here is an adventure story whose theme is sex. It is not in the least sexy by usual rental-library standards. A pocket-book publisher who was true to the text—though who is?—could not even find an adequately bosomy wench for his cover, unless he were to go overboard and show the battle of the brood-queens. With thorough de Campian deftness and logic every situation of the beelike humanoid society is built up to its inevitable, though far from evident conclusion, in as innocent a plot as you could wish—but odds are that the story could never withstand the post office and newsstand taboos which stomach pornography but condemn subtlety. It is to be hoped that publishers will look for and find more books like this—science fiction to the core, but adult throughout.

A much more novel step has been taken by Raymond J. Healy, co-editor with J. Francis McComas of "Adventures in Time and Space"—Random House, 1946—in his collection of ten brand-new stories on ten themes by—as it happens—eleven authors. In a degree Bleiler and Dikty had stolen Healy's thunder by commissioning one original story for their "Best Science-Fiction Stories: 1951," but the concept of a written-to-order anthology to replace the usual process of gleaning has unlimited possibilities, especially in the hands of a creative editor.

"New Tales of Space and Time—Henry Holt & Co., New York. 1951. 294 pp. $3.50—as the book is called, contains two absolutely top-notch stories which will undoubtedly be reprinted elsewhere and often. One of these, Anthony Boucher's "The Quest for Sain Aquin," would have had difficult sledding in most magazines, for its unorthodox treatment of some of the basic philosophical problems of religion and the tone of gentle mockery with which it follows the adventures of the fugitive priest Thomas and his "robass" companion, as he searches for a new saint in a future world where followers of any religion are hunted down. The other, Kris Neville's "Bettyann," is an original, human, moving story of the inner conflict within a child of an alien race, adopted by mankind and brought up as a human being, when she discovers her true heritage. These two stories are worth the price of the book. If they can be classified, they represent the "Alien Race" and "Future Vignette" categories.

The quality of the other eight stories is also well up to the standards of current publication. Ray Bradbury opens the book with a typically poetic concept of the alien character of another world, "Here There Be Tygers," not one of his best stories but well ahead of most of the field. Cleve Cartmill has done a neat, taut, mystery of the not-too-far-distant future in "You Can't Say That," with an aside to our growing trend toward censorship and secrecy in government. R. Bretnor brings back Papa Schimmelhorn of the now classic "The Gnurrs Come From the Voodvork

Out" with an adolescent relative who has even more hilariously developed powers, "Little Anton."

Isaac Asimov's contribution to the book, "In a Good Cause—", is superficially the story of the work of a rebel against authority, but carries a neat little hooker to justify the quotation from which its title derives: "In a good cause, there are no failures." From A. E. van Vogt comes the book's robot or cybernetic story, "Fulfillment," and from Gerald Heard a characteristic enlargement of his proposal that the flying saucers are piloted by bees from Mars, "B + M — Planet 4." Heard's style appeals strongly to some readers and poisons others like an over-age clam, but there is a possible hidden catch to the character of the dwarf humanoid which might be considered in connection with the "secret" of de Camp's "Rogue Queen."

There remain two time-travel stories: "Tolliver's Travels," by Frank Fenton and Josepli Petracca, which uses a device from fantasy to carry its Hollywood script-writer into a future of unbounded "happiness," and your reviewer's "Status Quondam," which carries a geologist to Periclean Athens. A time story of the latter type should recreate the minutiae and atmosphere of the past as authentically as do the pages of Boswell's journals for eighteenth century London; that, plus the contrasts of plunging a modern man into it, are its reasons for being. I'm afraid that it can't be done successfully in ten thousand words: correction —I can't do it, though I'd like to and may try again.

Ray Healy definitely planned this made-to-order anthology as an "upbeat" collection, a deliberate swing away from the doom-croaking pessimism of so many current stories. The heroes of the two time-travel stories find home a very satisfactory place to be; Bettyann likes people; van Vogt's machine finds that it can live with men; Bradbury's planet reacts to men as they react to her; and, of course, Pappa Schimmelhorn loves everybody, especially blondes. Yet there is nothing Pollyannaish about the book or the individual stories. In at least one case Healy worked hard and long with the author to get the effect he wanted. Readers should find the result worth the effort — and no one should miss "Bettyann" or "The Quest for Saint Aquin."

Let us hope that other anthologists will take up the challenge and give us more collections of the new, as well as the best of the old.

As this goes to press, Shasta Publishers have just announced an annual competition for the best original, unpublished science-fiction novel with "no magazine taboos." There will be a grand prize of $250 with a $750 advance against royalties—$1000 in all —and runners-up may also be published. Entries in this first contest must be in by June 30, 1952. A year from now there may be a great deal to write about in a discussion like this.

Also on the side of novelty is the announcement that Don Day of 3435 Northeast 38th Avenue, Portland, Oregon, will soon publish an index to magazine science-fiction since 1926— 8½ by 11 inches, cloth or fabricoid bound, with both title and author indexes. Very little fantasy will be covered. The book will run to about two hundred pages, in an edition of two thousand; Day reports that the price will be $6.50 after publication, with a pre-publication price of $5.00. Here is a companion-piece to the Shasta "Checklist."

And Fantasy Press, not to be outdone, has met a long-felt need with a line of science-fiction and fantasy bookplates—exactly what you need if you like to fit your bookplate to the type of book. The first lot, at $2.00 a hundred, includes three by Edd Cartier, three by Hannes Bok, and six by Ric Binkley, F.P.'s current staff artist. On second look, Cartier may have done four, for I believe he did the robot-and-press Fantasy Press colophon, which is one of the lot.

THE BEST SCIENCE FICTION STORIES: 1951, edited by Everett F. Bleiler and T. E. Dikty. Frederick Fell, Inc., New York. 1951. 352 pp. $2.95

The Bleiler-Dikty selections, of which this is the third, have established themselves as intelligent, representative, well-balanced panoramas of the science-fiction field. In spite of the title, the period covered is 1950, there seems, also, to be an even greater spread of sources than in either of the previous volumes, with nine magazines represented and one story, Frank M. Robinson's "The Santa Claus Planet," an original written for the book. There is the usual interesting and thoughtful introduction by the editors.

This magazine is represented twice, with Alfred Bester's superman tale, "Oddy and Id," and Roger Flint Young's minutely worked-out story, "Not to be Opened." Among other choice items are such rare comedies as R. Bretnor's "The Gnurrs Come From the Voodvork Out," Sprague de Camp's "Summer Wear," and Bill Brown's "The Star Ducks," and such grim little items as Richard Matheson's "Born of Man and Woman," Cyril Kornbluth's "The Mindworm," William F. Temple's "Forget-Me-Not," and especially Fritz Leiber's "Coming Attraction." Damon Knight's "To Serve Man" has one of the neatest last-line punches of all time, with Fredric Brown's "Last Martian" running up. Ray Bradbury is represented by his already-famous time-travel mystery, "The Fox in the Forest," and A. E. van Vogt by a fine picture of alien life in "Process." For the variations on human—or humanoid—society, which the editors consider to be the current trend in the field, we have the Robinson story, Katherine Mac-

Lean's biological mystery "Contagion," Frank Belknap Long's "Two Face," and especially "Trespass," by Poul Anderson and Gordon Dickson, which raises some beautiful complications among the legal aspects of time travel. Finally, in a story which would have rated a "nova" or "thought variant" rating a decade ago, Charles L. Harness in "The New Reality" introduces a really new idea, that the structure of the universe is evolving with man's concepts of it.

You may have your own preferences for the eighteen "best" science fiction short stories of 1950, but you must certainly agree that the Bleiler-Dikty choices are in the top rank.

THE CASE OF THE LITTLE GREEN MEN, by Mack Reynolds. Phoenix Press, New York. 1951. 224 pp. $2.00

Readers who remember H. H. Holmes' "Rocket to the Morgue"—Duell, 1942—with its science-fiction background will find an amusing parallel in this first mystery by a practicing science-fiction writer. Jeb Knight, its sad-sack private detective, is hired by a trio of fen—members of the exclusive Scylla Club—to find out whether Earth is being peopled by incognito aliens from the stars. One of his clients is promptly murdered under seemingly impossible circumstances; a witness finds a heat-ray burn on his bedroom wall; another fen is found with a neatly burnt hole over his heart and a scent of ozone in the air at the AnnCon, tenth World Science Fiction Convention. If the person behind these events is more apparent to the reader than to the police or Jeb Knight, the atmosphere of fen, BEMs, and pros is still good fun, and Jeb is a very likable and very plausible character. With more experience he may be up to more intricate puzzles, and we hope some of them will bring him back into the aura of the Scylla Club.

FOUNDATION, by Isaac Asimov. Gnome Press, New York. 1951. 255 pp. $2.75

The revision and inter-writing of Isaac Asimov's "Foundation" stories which he has done for this book is not quite so successful a job as the one he did last year with his positronic robot tales in "I, Robot." There was a fascination about the working out of various facets of the famous laws of robotics in the latter stories which is not quite there in the development of the Seldon crises in the new book. (Will the writers of jacket blurbs *please* get names straight?)

"Foundation" takes us through the first four stages in the dissolution of the Galactic Empire and the unconscious efforts of the First Foundation, on Terminus, to shorten an interregnum of thirty thousand years to a mere thousand. We meet Hari Seldon and watch him out-maneuver the politicians of the Empire and secure a haven for his Encyclopedists in the galactic Periphery. Fifty years later, with Salvor Hardin, we face the first predicted crisis of invasion by the fragmented kingdoms which have developed out of the ruins of the old Empire. In another thirty years comes the second crisis, and a new balance through the use of a new type of power. Finally comes the era of the Traders and Merchant Princes, and a third crisis in the resurgence of a degenerate Empire, again met by another of the social forces which Hari Seldon's science of psychohistory permitted him to foresee.

"Foundation" covers a little more than two hundred years in the history of the Foundation. The episode of The Mule, the search for and discovery of the Second Foundation lie ahead. It is to be hoped that Gnome will give us the full series in time.

THE HOUSE OF MANY WORLDS, by Sam Merwin, Jr. Doubleday & Company, New York. 1951. 216 pp. $2.75

Along with the growing pains which science fiction has developed as a result of its relatively recent acceptance into the family of "literature" there seems to have come a false sense of its own importance. Editors, reviewers, readers, and doubtless grubbers for Ph.D. theses are searching doggedly for "significance" in every new story to leave the press. The merits of a just-plain-good-story seem to be overlooked.

Sam Merwin, who as editor and reviewer has proved himself a good judge of good stories—and of the other usually mentioned concomitants—has now spun a good adventure-intrigue yarn of his own. Reporter Elspeth Marriner and photographer Mack Fraser, smelling out the mystery of Spindrift Key, find themselves up to their necks in a plot which involves three parallel time-tracks. One, in which they are sent as catalysts to avert a continental war, has resulted when Aaron Burr's conspiracy succeeded, Napoleon escaped to Mexico from St. Helena with American—or rather Columbian—assistance, and in 1869 the North attempted to secede from the Republic and its oligarchy. A democratic insurrection is complicated by aspirations of the Mexican Empire to take over the entire continent, and by the fact that this world lacks heavier-than-airflight—but has built a Mars rocket and has disintegrators. They are then shuttled to the world of a colleague, the beautiful Juana, in which technology has so outstripped the humanities that a cataclysmically soaring population is on the verge of global suicide. Space flight, as developed in World Two, may be the release needed to prevent disaster. A nasty young blackguard of a No'therner who occasionally uses the name Everard van Hooten turns up at all the wrong times and eventually swipes the Plans and the Formula, as his kind have been doing since the days of ancient Egypt and Sumer.

It's roundly entertaining, it's firmly plotted, and it's fully packed with all sorts of neat little bits of color and detail. And it closes with a lovely little hooker on the last page but one.

SPACE ON MY HANDS, by Fredric Brown. Shasta Publishers, Chicago, Ill. 1951. 224 pp. $2.50

The family of the future whose portrait by Malcolm Smith is on the jacket of this selection of nine top-notch stories may well be that of the expatriated Martian, Cirderf Nworb, who has been turning out some of the best current detective stories and has wielded an unabashed slapstick on the august person of Science-Fiction. He is certainly responsible for the hair-drier which the fetching woman of the family seems to have built into her space-helmet.

All of these stories, to judge from the credits, have apeared in other magazines than this. Some have been anthologized; others may be brand new to you. Most of them are worth rereading anyway, if you don't take too serious a view of what should go on in such places. That the four hundred sixty-eight brightest stars should cavort around the heavens—that five bug-eyed monsters should call on a science-fiction writer—that a man should be murdered in five different ways, simultaneously and mutually exclusively—that a family of space-rovers should find an ostrich wearing a bow tie, a false-front saloon, and a movie star on an unknown planet of Sirius—that a mouse should return from the Moon with a Minsky-German accent: these things Fredric Brown asks you to accept. Then there is the tricky little story about the last man on Earth, "Knock," and the spine-creepy "Come and Go Mad." And a rare twist to a detective story laid for convenience in 1999. You'll have fun with this one.

WORLD OF WONDER, edited by Fletcher Pratt. Twayne Publishers, New York. 1951. 445 pp. $3.95

Fletcher Pratt, who needs no introduction here, proves himself as discerning an editor as he is an historian with this anthology of nineteen science-fiction and fantasy tales. Reaching back to Kipling, O. Henry, and Gouverneur Morris, he comes down to 1951 with H. Beam Piper's tricky little exchange of diplomatic correspondence in "Operation RSVP." He has held his selections from this magazine to less than half of the collection —which means novelty to many faithful readers—and has provided such surprises as Franz Kafka's "Metamorphosis" and the unexpurgated version of Esther Carlson's grisly little "Museum Piece." Beyond them we have such of the faithful as Asimov, Tenn, Brown, Blish, Heinlein, de Camp, Merril, Bond, Chandler, and Bradbury, with Philip MacDonald, an occasional but very potent stray-over from the mystery field.

The editor throws in a highly competent introduction on "The Nature of Imaginative Literature," with thorough analyses of each story to boot. In the introduction he sets up four standards for good imaginative fiction, which are worth condensing here: (1) the problem presented by the story must be a human problem; (2) the writer is allowed only one premise or assumption, stated early in the story and never violated—the prohibition against inconsistency is stronger in imaginative literature than in any other field of fiction, Mr. Pratt maintains; (3) in science fiction, no established scientific fact may be violated except when the violation itself constitutes the basis of the story and is plausibly explained; and (4) in pure fantasy, no established fact of normal psychological behavior may be violated unless, again, that makes the story. No special phenomena just for effect, says Fletcher Pratt.

FAR BOUNDARIES, edited by August Derleth. Pellegrini & Cudahy, New York. 1951. 292 pp. $2.95

The twenty stories collected here comprise the second in August Derleth's series of source-books in imaginative literature. Last year, in "Beyond Time and Space" (Pellegrini, $4.50), he went clear back to the Greek and Roman sources; in this companion volume the oldest of what he calls the "primitives" dates from 1785—a balloon trip to a utopia on the Moon.

The book as a whole will be more readable than the earlier one. J. A. Mitchell's "The Last American" (1889) is still a good burlesque of our life at the turn of the century—and today—though a little heavy-handed. A second section of "mid-period pieces" actually range in publication date between 1936 and 1949, while the eleven selections from "the contemporary scene" run back to 1944. What the divisions illustrate, of course, is evolution in attitude toward science fiction rather than hard-and-fast changes in types of story. Wandrei, Highstone, Grendon, Jacobi, and Bloch are presented as representative of the middle period—names more closely associated with fantasy than main-line science fiction. For the moderns we are given Leinster, Long, van Vogt, Harris, Carter, Grendon, Bond, Bradbury, Holmes, and Leiber, though, again, the stories chosen seem to represent maturation of older themes rather than the introduction of new ones.

Remembering that these are intended as period pieces, representing "off-trail" pioneering at three levels, no reader should be disappointed in the book and many who disliked "Beyond Time and Space" will enjoy this "appendix" to the larger volume.

THE END

(*Continued from page 6*)

not."

The neurosurgeon to whom I spoke made another point; this point I pass on; and with it an invitation to contribute to Brass Tacks some highly interesting comments. He commented that, if you want to find out how to make sulfuric acid, you go to a chemical engineer who makes the stuff; if you want to find out how iron is made, you should ask someone who makes iron. And, similarly, if you want to find out how human beings think—the real authorities are *people who think for a living*. The theory of creative thinking has never been worked out; it is not logic, but something else, because logic can derive only wrong answers from wrong data—but creative thinking somehow succeeds in getting right answers from inadequate, misinterpreted and irrelevant data.

The readership of this magazine quite evidently is interested in creative thinking; a high proportion of us are professionally engaged in making a living by creative thought. Very well, gentlemen—how do you do it?

The basis of the scientific method is that there is no higher authority than the real operation itself. The authority on sulfuric acid making is not the theoretical physical-chemist, but the successful chemical engineer—because if the engineer's data of actual operation disagrees with the theoretician's theory, the theory goes back for revision.

Your thinking itself is the final authority on how creative thinking is done. *How is it done?*

Another basic of the scientific method is that it works by stating dogmatic, absolutistic postulates—and then looking for the fact that will break the statement, for that new fact will aid in formulating a better, more accurate statement. The "rubber" statement of the order "Some individuals, under certain conditions, occasionally display a tendency to float six inches off the ground," on the other hand, can never be disproved. You never saw anything like that. *Tsk, tsk*—doesn't prove it's wrong—just shows that you weren't around when one of those rare individuals was under the right conditions—undefined, please note—that provoked him to display his tendency to float six inches off the ground. You haven't disproved it at all. Furthermore, you never will, and I can go on happily down my nice blind alley looking for one of those individuals under the right conditions, and be convinced I can prove it some day—and no one can prove I won't, either.

That sort of rubber statement gets us no forwarder. It's typical of the mystic and the nonscientist only; anyone calling that sort of statement a "cautious, scientific statement" is not aware of the basic requirements of the scientific method. Newton made some scientific statements; they're not noticeable for their delicacy or conservatism; "Every body in the Universe attracts every other body in the Universe with a force . . ." So he was wrong; Mercury's motion proved him wrong. If he'd made his statement a bit more cautiously, Einstein would never have developed the theories of relativity to the point he did.

So let's make some good, solid, scientific postulates—and then knock them down. And here's one to start with:

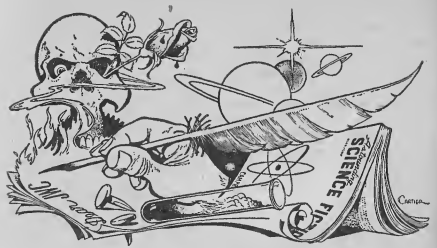
Postulate that a mechanism exists in the mind which has the sole function of correlating data-sets, and assigning to those data-sets correlation factors. These correlation-factor values might be expressed as two sets of symbols; the A and B correlation factors, we'll say. The A factor is the probability of recurrence, and the B factor is the correlation factor between the data sets. Thus the correlation factor between cats and peacock-type plumage is −1.00—cats *never* have peacock plumage. The probability of recurrence is zero. The correlation factor between cats and meteors is zero; no probability of recurrence factor needed. Cats have no connection either plus or minus with meteors. But cats and mammalian type fur have a high correlation value, approaching +1.00, and a fairly high probability of recurrence value, because furred cats are reasonably common in our environment.

How this correlation mechanism works, I don't know; allow the postulate it exists, however, and deduce consequences. It then appears that a logical computing mechanism, equipped with such a correlating mechanism, will be able to get correct answers from largely incorrect data,, if only a great enough mass of data is fed into the mechanism. The individual data, working in a cross-correlator, capable of performing logical operations, would eventually work against each other to a point where only correct data would have weight enough to affect the results put out. In effect, a correlating function, plus a logic function, would act on data stored in a very high capacity memory, to make each datum in memory act as a separate negative feedback stage to cancel each individual error.

A mechanism operating on the basic premise that there is some degree of correlation between any two data-sets in the memory storage, with value ranging from negative one to positive one—"never" to "always"—could correct its own data. And it is true that any two data-sets put in the memory of a human mind *do* have a correlation value, a small, positive correlation, in at least one sense; every datum in your memory bears a sequence-correlation with all other data in your memory.

Don't like that postulate? Fine enough—what's yours?

THE EDITOR.



BRASS TACKS

Dear John:

Mr. Hubler, who in ASF for November '51 commented upon my article on mad scientists in ASF for June '51, is misinformed in several respects. He gives six thousand dollars a year as the cost of putting a student through college, but this is about three times the actual basic living-cost of a single youth, even in these inflated days. As for tuition, while poverty is, of course, a handicap to anybody, most states run State universities free to residents, and even in private colleges there are hundreds of scholarships available to bright boys, and part-time jobs to help out are common.

My own college gets about eight times as many applications for admission as they accept, and they go to great trouble to try to pick the most intelligent eighth. They screen the applicants by their high-school marks, by tests of information, aptitude, and reasoning power, and by personal interviews. As for the training received, if Mr. Hubler doesn't think that intelligent thought is required to solve a problem in integral calculus or chemical engineering he ought to try it. And as for interrogating scientists and noting whether they are reasonable, I have been doing just that for twenty-odd years.

The rest of Mr. Hubler's letter cannot very well be answered because it doesn't really say anything except that Mr. Hubler, for reasons not stated, but no doubt connected with the atomic bomb, hates science and scientists. And who can gainsay that? To argue with an emotion is notoriously futile.

It would, however, be interesting to know how much of Mr. Hubler's frenzy is based upon a first-hand acquaintance with science and how much on hearsay.—L. Sprague de Camp, Wallingford, Pennsylvania.

The physical scientist is blamed for the danger of atomic warfare—but it is the failure of social and mental sciences that makes atomic bombs a threat. The fact that an atomic bomb exists does not *mean you have to kill people with it. Whether it is so used is a social-mental, not a physical, problem.*

Dear Mr. Editor:

Tonight I started to read the September issue of Astounding Science Fiction but I had read no further than your article, "Note for Chemists" when I stopped. It stopped me from reading and started me on the path of serious thought. You spoke of the biochemist consciously evolving strains of living organisms to produce the complex chemicals that man wants. One of the men who studied the tobacco mosaic dreamed of something very

much like that when he tried to introduce foreign groups into the crystalline form of the mosaic and then hoped that the mosaic would reduplicate the adjusted crystal in the new form. It did not work then but, with new methods and a few variations, it could work now. The tobacco mosaic and other mosaics like it, half alive, half crystalline, might indeed be a starting point for what you consider the future development of chemistry.

We have produced by selective "breeding" various strains and mutations of microorganisms which can produce an unlimited list of materials. We can block the normal life cycles and take out the new-formed waste products. I suppose you have thought of all of these but have you also thought or heard about the work of Hans Davide, a Swedish Bacteriologist and his work on what he calls Protaptin. *Life* reported on his work briefly. He raised a harmless bacteria on a culture of broth and dead T.B. germs and by gradually reducing the amount of broth he made them learn to live wholly on the germ. Finally they were allowed only the living germ. The harmless bacteria Proteus had to learn to digest the germ and to do so had to secrete a special chemical which could crack the almost impregnable waxy coating of the germ. An extraction of the chemical and its synthetic production for use in animal experimentation has taken place and has been successful. They expect to try the same methods on other germs also. This set of examples is as close as I have come to finding anything like a selected organism development as your article suggests for the future. If any come up, I would appreciate hearing about them.

I enjoy your magazine and your radio program very much. Your mag is a jewel among the stones of the common run of pulp mags whose stories are turned out of the bottomless sameness of a bunch of moronic minds. The radio program is one of the few I can really enjoy. The lack of excessive commercials has made it my favorite program. Too bad it isn't much longer.—Robert Hyke, 409 N. Murray, Madison, Wisconsin.

REALLY growing crystals!

Dear John:

To answer Mr. Robert L. Rorschach —Astounding, November '51—the Gand system of economics operates not only in fiction but to some degree in fact. It is a satisfactory alternative to orthodox methods in prisons, army barracks, among close friends, shipped seafarers and certain small racial groups. The Yap Islanders use it with the help of stone cartwheel "money" as idolistic evidence of who owes the least obs and is owed the most.

Any goods or services provided by one to another constitutes "planting an ob." Therefore all obs cannot possibly be of the same worth. The value of any given ob is determined by the recipient and not by the donor. Natural consequence is that a Gand tends to plant his obs where they will bring the best reward and withhold them where they bring the least. A stingy recipient who persistently undervalues obs soon finds himself up against the F.-I.W. principle and gets offered no more. The good old law of supply and demand still works!

A functional-ob, as distinct from ordinary, everyday ones, is nothing more than recognition of public service. A policeman or other civic official who buys something out of wages provided by the community is exercising the nearest Terran equivalent of a functional-ob.

As for the problem of growing enterprises run by two or more people whose opinions may differ and gradually widen, it is really no problem at all when the mentalities involved are those of good faith. I invite Mr. Rorschach to study the business methods of members of the Society of Friends. Their principle in such cases is that a project must be accepted unanimously or it is dropped until such time as complete agreement is achieved. When one considers the remarkable success of Quakers one must admit that their ideas work—though admittedly among like minds noteworthy for forbearance and business integrity.—Eric Frank Russell, Hooton, England.

He's right, at that! The way to make the most of your efforts is to work for the highest ob-value. The man who is most competent can and will afford to put the highest value on obs, and will, in consequence, get the most service from others!

Dear John:

In regard to Edger R. Schot's letter in the November Brass Tacks in which he suggested an ingenious means of perpetual propulsion, I'm afraid Cyrano got in ahead on the patent. I quote:

"Finally—seated on an iron plate, to hurl a magnet in the air—the iron
Follows—I catch the magnet—throw again—
And so proceed indefinitely."

p. 203 "Cyrano De Bergerac," Rostand Modern Library Edition.

It's hard to invent anything new nowadays, and Cyrano was an inventive fellow. This version of the invention in fact is even simpler, for it saves the electricity consumed in reversing the polarity by using one magnet and a man rather than two magnets.

Nobody seems to want to try it, which I think is very unsporting of them.

The October cover had been the best of a long series of beautiful covers with a predominantly bluish tone. The November cover was an unpleasant shock. I hope the limited picture with a garish yellow border is not here to stay. I like the looks of ASF the way it was, and the bluish look to its covers always let me see it easily on a newsstand full of dominantly reddish and circus-colored magazines.—K. MacLean.

It is unfair to recommend experimentation and condemn ours in the same letter! We're experimenting on format; sorry the first one didn't work out well—but we're learning!

Dear Mr. Campbell:

Your contention that modern computing machines duplicate thinking processes, only greater complexity being required to achieve a reasonable approximation of human thinking, is open to serious question on many grounds. Having been intimately concerned with the design and development of electronic and electromechanical computing devices of various kinds for many years, I have very frequently asked myself what can and can not be done by them, and the answer so far has always been determined by the realization that the one thing I cannot design, is a machine that thinks!

A great deal of hogwash has been publicized to the effect that we are at last approaching thinking machines, and undoubtedly it all makes very good copy, but it doesn't make good sense! The seed appears to have been sown when, in 1934, Dr. Black patented his stabilized feedback amplifier and introduced the electronic fraternity to the feedback principle. By the end of the 30's the principle had attained widespread recognition, and it became a sort of fad among the "boys" to identify the feedback principle at work in sundry fields.

During the early years of the war it was uproariously funny to point out that the trouble with engineering management was that there was no good liaison, between engineers and administrators, to close the feedback loop. Marc Ziegler of Philips—Eindhoven—once mentioned to me that even the birth rate was, after all, bound by a relatively simple feedback loop. But already the joke was wearing thin because all of us had pretty well recognized the fact that every physical system is of necessity a feedback system, of the kind that Dr. Black had patented.

A feedback system, or "servo", is a system wherein the output subtracts from the input, and nature hasn't yet made a system in which the output does not subtract from the input. With this realization the pastime of identifying this system and that system as a feedback system became less amusing, if not downright boring. Dr. Wiener with his "Cybernetics" has added the finishing touch rather neatly. We must certainly agree with him that the human mechanism is a servo mechanism, simply because no mechanism can possibly be anything else but a servo mechanism!

Thinking may or may not be a purely mechanical process. Personally I believe that it is purely mechanical, but it is nevertheless a mechanical process far removed from anything I have yet come across in actual machines. Computing machines compute, they do not think. Computing does not and never did require thinking, in fact thinking impedes it! Anyone who has had to develop facility in mathematics must be aware that computing must be done *without thinking*, or it will take forever and will probably be shot through with errors all along the line.

If one wishes to become a mathematician, one does endless mathematical exercises, just as a musician does endless exercises on his chosen instrument, the object being, in both cases, to develop such facility that the operations can be carried through without thinking. Unfortunately it is difficult for humans to get to the point where they can operate without thinking, but machines can't operate any other way, and that is the reason that machines can beat the technique of any human mathematician or musician!

This business of confusing computing with thinking has an ugly side to it which should be given serious attention. Far too many young engineers have deluded themselves into supposing that computing ability and thinking ability are one and the same thing. The result is too many would-be computers and not enough thinkers! A computer is capable only of applying a given method to the solution of a given problem. A thinker is capable of creating a method to be applied to the solution of a problem he thought of. There is a very great difference between the two.

On behalf of good—human—computers, let me close with the observation that a good computer is a good craftsman, and craftsmanship is worth attaining in any field. Furthermore, craftsmanship is worthy of our greatest admiration, be it craftsmanship in music, machine-tool operation, or mathematics. But machines can inevitably be designed which can supplant even the highest of human craftsmanship, so the craftsman needs to be more than just a craftsman if he is to survive. Perhaps, even then, machines will eventually be designed which can overtake him, but they are not yet on the horizon, not even as pipe dreams!—F. Sutherland Macklem, 1054 Hunter Avenue, Valley Stream, Long Island, New York.

Joining the absent-minded professor is now the thoughtless mathematician? Actually, I see your point. Arithmetic does not call for thought; true mathematics does.

Dear Mr. Campbell:

I have just recently been introduced to Science Fiction and enjoy it immensely—particularly the under-

lying optimistic trend that appears in the stories and editorials. And I like the editorials especially for they are the only ones I have ever felt compelled to write about—as compared to other magazine and newspaper editorials. What interested me mostly in the July editorial was your conclusion on the last page that "his [man's] instincts are good." It seems to me that you are falling into the same error as those who feel that our animal instincts are our downfall, because you are making a value judgment of them. Are instincts inherently good or evil? I think not. They have tremendous possibilities for either, and that may be why there are evidences of unspeakable barbarism and wonderful strength in modern civilization. They are useful tools, to be used more and more fully as one becomes more conscious of what he really is and of his creative possibilities.

I might have taken the point more seriously than you have intended, but I feel better for having written.

Are you familiar with the philosophy and psychology of C. G. Jung? I find so many bits of it scattered through the magazine.—Mary Hopkins, 336 Emerson Street, Palo Alto, California.

My evaluation "Good" is necessarily based on what appears to me to make for the finest type of ideals. But, if my idea is right, that's just instinctive, isn't it?

Dear Mr. Campbell:

Here's my vote on the October issue:

1. "The Years Draw Nigh." You don't have enough by del Rey. The only thing wrong with his story is that I have shuddered every time I have thought of "Years Draw Nigh" since reading it. It just can't be all empty up there. Or can it?

2. "Ultima Thule." Eric Frank Russell is a long-time favorite. This expanding creation and seventeen thousand years from the past leaves me, but I enjoyed it.

3. "The Head Hunters." Well written, but . . . All Neely can think about is having a head for his collection. Looks as if Ralph Williams could have developed this one better so that Neely and the guide—who started out as the one with brains and wound up as Neely's flunky—got interested in the fact that the panda was from space, not merely another head for the trophy room.

4. "Thinking Machine." Not up to Fyfe at his best. Can swap with three.

5. "Iceworld." Not really to be rated until the end of the serial. I put it here to ask a question or two. Maybe you've got a host of eager beavers you know who can find time to answer. My science is confined to a quick dash through physics and chemistry and calculus. Even or—or because of that—I don't follow the reasoning. Sallman Ken comes from a world where the surface temperature is 500 degrees C. Converting to F, which I understand better, that's 932 degrees. Certainly any competent engineer ought to be able to make his tubes stand up under the 720 differential between that and Earth boiling point.

If—I'm accepting Hal Clements' word for this—tin, lead, et cetera, melt at Sarrian surface temperature, what do we build anything out of? Haven't we set up a technology so far removed from the concept on Earth that intercourse is impossible? Yet we drop torpedoes to the Earth's surface and they look like tin fish from a sub. If they can do that, they can surely build TV tubes from whatever kind of glass they—Sarrians—use so that it can stand the temperature variation.

My non-scientific mind is too puzzled. What it really balks at boils down to: How can you have any technology at 500 degrees C? Won't all the basic materials in the atomic chart melt down to a fluid state? Is Sallman Ken therefore fluid? O.K., so he's iridium and smokes sulfur fumes. What can you make TV tubes and wires out of at 500 degrees C?

Questions? Answers? That's why I read ASF. To get my liberal arts mind onto a technical level and into the realm of ideas. Thanks for listening.—Kinsley McWhorter Jr., 207A Albemarle Avenue, S.W., Roanoke, Virginia.

Iron, titanium, and a number of other metals are solid far above 500C. Ceramic materials in plenty would be available.

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